FINAL ENVIRONMENTAL IMPACT STATEMENT ON PROPOSED

MODIFICATIONS AT SUNNY ISLES, DADE COUNTY BEACH EROSION CONTROL AND HURRICANE PROTECTION PROJECT, DADE COUNTY, FLORIDA

The responsible lead agency is the U.S. Army Corps of Engineers (USACE), Jacksonville District. The cooperating agency for preparing this Environmental Impact Statement and the non-Federal sponsor is the Dade County Department of Environmental Resources Management.

ABSTRACT: This Final Environmental Impact Statement (FEIS) describes the selected plan and the alternative evaluated to provide additional shore protection measures for the Dade County Beach Erosion Control and Hurricane Protection Project (BEC&HP) to reduce spreading (end) losses at the north end of Sunny Isles. The recommended Plan includes the combination of beach renourishment, the construction of a transition fill, and the construction of a geo-textile breakwater. The plan consists of constructing a 120-foot wide berm (20 ft. design and 100 ft. advance maintenance berm), constructing a segmented offshore breakwater using geo-textile tubes, and constructing a 1500-foot beach fill transition into Golden Beach. A total volume of approximately 988,000 cubic yards of material will be required to construct the beach fill and transition, and to fill the geo-textile breakwater tubes. The source for this material will be borrow areas located south of Government Cut and East of Key Biscayne. The compatibility of the fill material with that of the existing beach will determine recolonization of the beach by invertebrates as well as its suitability for use by nesting sea turtles and subsequent hatching success. Geotechnical analysis of the borrow area indicates that the material is compatible with that on the beach. The benthic community within the area dredged will reestablish itself within a short period of time after construction is completed. The borrow areas have been designed with buffer zones away for hardground communities to minimize impacts to these resources that are associated with dredging. A pipeline corridor has been identified that will minimize impacts from placing the discharge pipeline across the first reef.

PLEASE SEND COMMENTS TO THE DISTRICT ENGINEER WITHIN 30 DAYS OF PUBLICATION OF THE FINAL EIS IN THE FEDERAL REGISTER

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NOTE: Information, displays, maps, etc. discussed in the Dade County Shore Protection Project Modifications to Sunny Isles Segment, Design Memorandum, Addendum III, are incorporated by

reference in the EIS.

SUMMARY

FINAL

ENVIRONMENTAL IMPACT STATEMENT

ON

PROPOSED MODIFICATIONS AT SUNNY ISLES

DADE COUNTY BEACH EROSION CONTROL

AND HURRICANE PROTECTION PROJECT

DADE COUNTY, FLORIDA

Need or Opportunity. The project is located on the southeast Florida coast within Dade County. The proposed work would be performed as part of the Dade County Beach Erosion Control and Hurricane Protection (BEC & HP) Project and is located within the community of Sunny Isles. Beach fill placed along the northern portion of Sunny Isles rapidly erodes due to spreading (end) losses. Following each previous beach fill placement, a large discontinuity in berm width exists at the Sunny Isles/Golden Beach City limit. Material from the wide post-nourishment Sunny Isles shoreline diffuses rapidly northward into Golden Beach, which is offset approximately 150 feet further landward immediately following beach fill placement. In addition, development along the northernmost 1100 feet of Sunny Isles encroaches further seaward than any in the region. The erosion control line (ECL) is located an additional 20-30 feet seaward of the seawall. This seaward encroachment of the seawall line and ECL at the northern end of Sunny Isles displaces the beach fill further offshore at the northern end of the project, further increasing the discontinuity in the post-nourishment shoreline position between Sunny Isles and Golden Beach. Spreading losses increase as the discontinuity in the berm width increases, thus adding to the difficulty of maintaining the project beach in this area.

Major Findings and Conclusions. These proposed project features are in the National interest and can be constructed while protecting the human environment from unacceptable impacts. Benefits of the proposed action would be to efficiently and effectively reduce the renourishment frequency of the Sunny Isles project and bring the renourishment interval for the eroding northern end more in sync with the rest of the segment. The proposed action would provide better protection against erosion and hurricane damage for the shoreline and shoreline properties. Adverse impacts would include increased turbidity and sedimentation in the vicinity of the borrow site (including over nearby reefs) during construction, increased sedimentation and turbidity along the nearshore environment at Sunny Isles and Golden Beach (mostly during construction and to a lesser degree after), some damage to reef organisms along the underwater corridor for the delivery pipeline, and potential impact on nesting or in-water sea turtles. Measures taken to avoid, minimize, and compensate for adverse impacts include a buffer zone between dredging areas and reef, delineation of the borrow area with lighted buoys, use of real time geo-positioning system on the dredge, monitoring of turbidity and sedimentation, no continuous dredging in a concentrated area, toe of the beach fill will not reach the nearshore reef, compensation of reef impacts with artificial reef modules (if the level of damage warrants), use of sea turtle observers and turtle deflecting draghead on any hopper dredge, monitor and relocate sea turtle nests, monitor for and correct problems with scarps and compaction on the beach, confine the underwater pipeline to an established corridor, and repair and/or relocate damaged coral to the extent possible.

Alternatives. Alternative plans being evaluated include, (1) beach renourishment along 2.5 miles of shoreline at Sunny Isles, (2) a transition fill seaward of mean high water off the Town of Golden Beach, (3) construction of one or more groins, and (4) the construction of a breakwater. Alternative sources of

sand considered include offshore borrow areas located south of Government Cut, deep water sand sources, distant domestic sand sources, foreign sand sources, and upland sand sources.

Preferred Alternative(s). The preferred alternative includes the combination of beach renourishment, the construction of a transition fill, and the construction of a breakwater. The optimum plan of improvement consists of constructing a 120-foot wide berm (20-ft. design and 100 ft. advance maintenance berm), constructing a segmented offshore breakwater using geo-textile tubes, and constructing a 1500-foot beach fill transition into Golden Beach. A total volume of approximately 988,000 cubic yards of material will be required to construct the beach fill and transition, and to fill the geo-textile breakwater tubes. The source for this material will be borrow areas south of Government Cut designated SGC-2 and SGC extension.

Issues Raised by the Public and Agencies. In addition to the potential adverse impacts mentioned above in the "Major Findings and Conclusions", some additional concerns were raised during the scoping process. This included a concern over safety, private property rights, and stability of the breakwater during a storm. It was suggested that the submerged breakwater would attract surfers and that it would pose a safety hazard to swimmers, surfers, and boaters. The breakwater would alter the wave climate and current pattern to some extent. The area would be marked if required by law or otherwise appropriate. The breakwater would be a "soft" geo-textile structure and not likely pose an injury hazard any more than a sand berm of similar configuration. Residents of Golden Beach expressed a concern that the proposed action would result in accretion of their private beachfront that might result in public beach. In addition, there were suggestions that corrective action be taken in the event that the project features (especially the breakwater) were to have undesirable impacts. We are prepared to take corrective action as required by the state or otherwise deemed appropriate.

Areas of Controversy. Beachfront residents at Golden Beach may have lingering concerns over the private beach issue and whether the proposed action would adversely impact the shoreline along Golden Beach.

Unresolved Issues. At the time the draft EIS was prepared there was an unresolved issue concerning the requirement for using red filters and low-pressure sodium lights on the dredge and beach construction equipment. This issue has been resolved, refer to section 4.27.2 ENDANGERED SPECIES ACT OF 1973, in the final EIS. Also, the issue of private property rights will have to be resolved by the state.

FINAL

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DADE COUNTY BEACH EROSION CONTROL

AND HURRICANE PROTECTION PROJECT

DADE COUNTY, FLORIDA

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AND HURRICANE PROTECTION PROJECT

DADE COUNTY, FLORIDA

1. PROJECT PURPOSE AND NEED

1.1 PROJECT AUTHORITY.

1.1.1 INITIAL AUTHORIZATION.

The Beach Erosion Control and Hurricane Protection (BEC & HP) Project for Dade County, Florida was authorized by the Flood Control Act of 1968 (see figure 1, site map). In addition, Section 69 of the 1974 Water Resources Act (P.L. 93-251 dated 7 march 1974) included the initial construction by non-federal interests of the 0.85 mile segment along Bal Harbour Village, immediately south of Bakers Haulover Inlet. The authorized project, as described in HD 335/90/2, provided for the construction of a protective/recreational beach and a protective dune for 9.3 miles of shoreline between Government Cut and Baker's Haulover Inlet (encompassing Miami Beach, Surfside and Bal Harbour) and for the construction of a protective/recreational beach along the 1.2 miles of shoreline at Haulover Beach Park.

1.1.2 SUPPLEMENTAL APPROPRIATION.

The Supplemental Appropriations Act of 1985 and the Water Resources Development Act of 1986 (Public Law 99-662) provided authority for extending the northern limit of the authorized project to include the construction of a protective beach along the 2.5 mile reach of shoreline north of Haulover Beach Park (Sunny Isles) and for periodic nourishment of the new beach. This authority also provided for the extension of the period of Federal participation in the cost of nourishing the authorized 1968 BEC & HP Project for Dade County, which covered 10.5 miles of shoreline extending from Government Cut north to the northern boundary of Haulover Beach Park, from 10 years to the 50-year life of the project.

1.2 PROJECT LOCATION.

The project is located on the southeast Florida coast within Dade County. The proposed work would be

performed as part of the Dade County Beach Erosion Control and Hurricane Protection (BEC & HP) Project and is located within the community of Sunny Isles (see figure 1, location map).

1.3 PROJECT HISTORY.

Three Federally-funded beach fills have been placed along Sunny Isles. The initial beach fill was placed in 1988 under the authority of the Dade County BEC & HP Project. In 1990, beach-quality material dredged from nearby Federal navigation projects at Bakers Haulover Inlet and the Intracoastal Waterway was placed along the northern portion of Sunny Isles. Again in 1997 the northern portion of Sunny Isles was renourished. Construction of the initial beach nourishment was begun in May 1988, and resulted in the placement of 1,320,000 cubic yards of fill along the entire 2.5-mile length of Sunny Isles. The construction berm provided by this project extended 110 feet seaward of the ECL, at an elevation of +9.0 feet, mlw. The volume of fill was designed to provide a beach with a renourishment interval of 10 years.

In response to rapid erosion at the northern end of the Sunny Isles project, material removed during maintenance dredging of the Federal navigation projects at Bakers Haulover Inlet and the Atlantic Intracoastal Waterway was placed along the northern portion of project in 1990. Approximately 30,000 cubic yards of material were stockpiled and trucked to the site. The fill was then placed along a 1300-foot reach of the northernmost portion of the Sunny Isles project, to replace material lost to spreading (end) losses over the two-year interval following initial construction of the project in 1988. The 1990 placement of dredged material reconstructed the 110-foot construction berm, which was placed in 1988, over the northernmost 1300 feet of the Sunny Isles shoreline.

Following completion of the 1990 beach fill placement, rapid erosion of material again occurred along the northern portion of the Sunny Isles project. Monitoring surveys performed in November 1991 indicated that the northernmost 1200 feet of the project was at or below the authorized 20-foot design berm width. In order to prevent storm damages to upland structures which could occur prior to the completion of this (Addendum III) study, an interim renourishment of this area was planned in order to reestablish the authorized project dimensions. The interim renourishment would provide for the placement of approximately 120,000 cubic yards of material along 3000 feet of northern Sunny Isles, commencing at the north city limit, and proceeding south. Material would be placed in a 70-foot wide construction berm throughout the 3000-foot renourishment length. Sand for the beach fill would come from a borrow area located approximately 1.5 miles offshore. A contract for performing this beach fill as well as renourishing a portion of Miami Beach was awarded on 24 May 1994 and construction commenced on the Miami Beach segment in July 1994. On September 7, 1994 a lawsuit was filed in Federal Court (Southern District of Florida), case Number 94-1816, Town of Golden Beach, Biodiversity Associates, Richard Jackson, and Donald Duerr vs. District Engineer, U.S. Army Corps of Engineers, Jacksonville District. As a result of this lawsuit, an injunction was issued on September 12, 1994 that stopped work in progress pending preparation of properly coordinated environmental documentation, and pending further order from the court. Upon the preparation and coordination of an Environmental Assessment and Finding of No Significant Impact for this project, the court dissolved the injunction on November 22, 1996. A second contract was awarded in January 1997 and the renourishment at Sunny Isles was completed in July 1997.

1.4 PROJECT NEED OR OPPORTUNITY.

Beach fill placed along the northern portion of Sunny Isles rapidly erodes due to spreading (end) losses. Following each previous beach fill placement, a large discontinuity in berm width exists at the Sunny Isles/Golden Beach city limit. Material from the wide post-nourishment Sunny Isles shoreline diffuses rapidly northward into Golden Beach, which is offset approximately 150 feet further landward immediately following beach fill placement.

In addition, development along the northernmost 1100 feet of Sunny Isles encroaches further seaward than any in the region. The erosion control line (ECL) is located an additional 20-30 feet seaward of the seawall. This seaward encroachment of the seawall line and ECL at the northern end of Sunny Isles displaces the beach fill further offshore at the northern end of the project, further increasing the

discontinuity in the post-nourishment shoreline position between Sunny Isles and Golden Beach. Spreading losses increase as the discontinuity in the berm width increases, thus adding to the difficulty of maintaining the project beach in this area.

1.5 AGENCY GOAL OR OBJECTIVE

1.5.1 Objective

The objective of the proposed project modification is to provide additional shore protection measures along the northern portion of the Sunny Isles segment of the Dade County BEC & HP Project to reduce the spreading losses at the north end of the project.

1.5.2 Proposed Action

For optimum increases in shore protection along the Sunny Isles Coastline a combination of shore protection measures have been studied. The proposed action consists of renourishing 2.5 miles of beach along Sunny Isles with a 120 foot wide beach berm, a 1500 foot beach fill transition along Golden Beach, and an offshore breakwater composed of two 375 foot segments of geo-textile tubes (see figure 2).

A 1500 foot transition fill was found to be the most beneficial length to smooth the discontinuity in berm widths between Golden Beach and Sunny Isles, greatly reducing end losses from the Sunny Isles beach fill. In addition, the transition would provide a source of material for salient formation in the lee of the proposed breakwater. This transition would be in the form of a sand berm seaward of the mean high water line. Due to the lack of easements north of the project area in Golden Beach, all construction of the beach fill transition would occur on State of Florida lands, which are located below the mean high water line. The transition will taper from 120 feet wide at the Sunny Isles/Golden Beach city limit to zero feet, over the length of 1500 feet.

The beach fill along the 2.5 mile length of Sunny Isles would be constructed at the authorized +9.0-foot mlw elevation with a construction berm width of 120 feet (20 ft. design berm; 100 ft. advanced maintenance). The front slope of the beach fill and transition will be 1 vertical on 10 horizontal from the berm to mean low water, and 1 vertical on 20 horizontal from mean low water to the existing bottom (figures 3 & 4). A total of approximately 988,000 cubic yards of beach quality material would be used to construct the proposed project. Approximately 73,000 cubic yards would be used to construct the transition fill, 913,000 cubic yards would be used to renourish the beach at Sunny Isles and 2,000 cubic yards would be used to fill the geo-textile tubes. However, these volumes may be less due to the Sunny Isles renourishment constructed in 1997. The proposed borrow areas are located south of Government Cut, as shown on figure 1. Due to the relatively large quantity of material required, and due to the large distance from borrow site to fill area, the most economical method of construction will be to transport material to an offshore pumpout site via hopper dredge(s) or scows. Material will then be pumped ashore for final placement. Rocks, shell and coral rubble are present in the borrow area and are not suitable for placement on the beach. Any material larger than one inch will be separated prior to placing the sand on the beach. The rocks, shell and coral rubble removed from the sand would be used to create an artificial reef and placed in a permitted artificial reef site located offshore of Miami Beach (figure 1).

An offshore segmented breakwater is also recommended to further stabilize the northern terminus of the Sunny Isles beach fill. It is proposed that the breakwater would be constructed of geo-textile bags filled with beach-quality sand.

The geo-textile tubes would be placed in a shore parallel configuration along the northernmost 1050 feet of Sunny Isles approximately 500 feet seaward of the existing seawall line. Two 375-foot segments would be placed, separated by a 250-foot gap. The geo-textile structure would be placed in 8 feet of water on a geo-textile fabric foundation. The existing site conditions consist of a layer of sand overlying rock. The filter fabric foundation is required to prevent excessive settlement of the geo-textile tubes. The geo-textile tubes would be constructed in place, from a barge. In simplified steps, the tube would be placed, floated into position, then filled with clean, beach quality sand mixed with water. Approximately

1000 cubic yards of material will be required to construct each breakwater segment. The slurry used to fill the tubes will cause turbidity due to outflow of the slurry mixture from the discharge tubes. Turbidity curtains will be required. Due to the necessity of maintaining a turbidity barrier and due to the inherent difficulties of positioning and filling the tubes, construction can only occur during periods of calm weather. To ensure a long enough period of calm water, construction would probably take place during the summer.

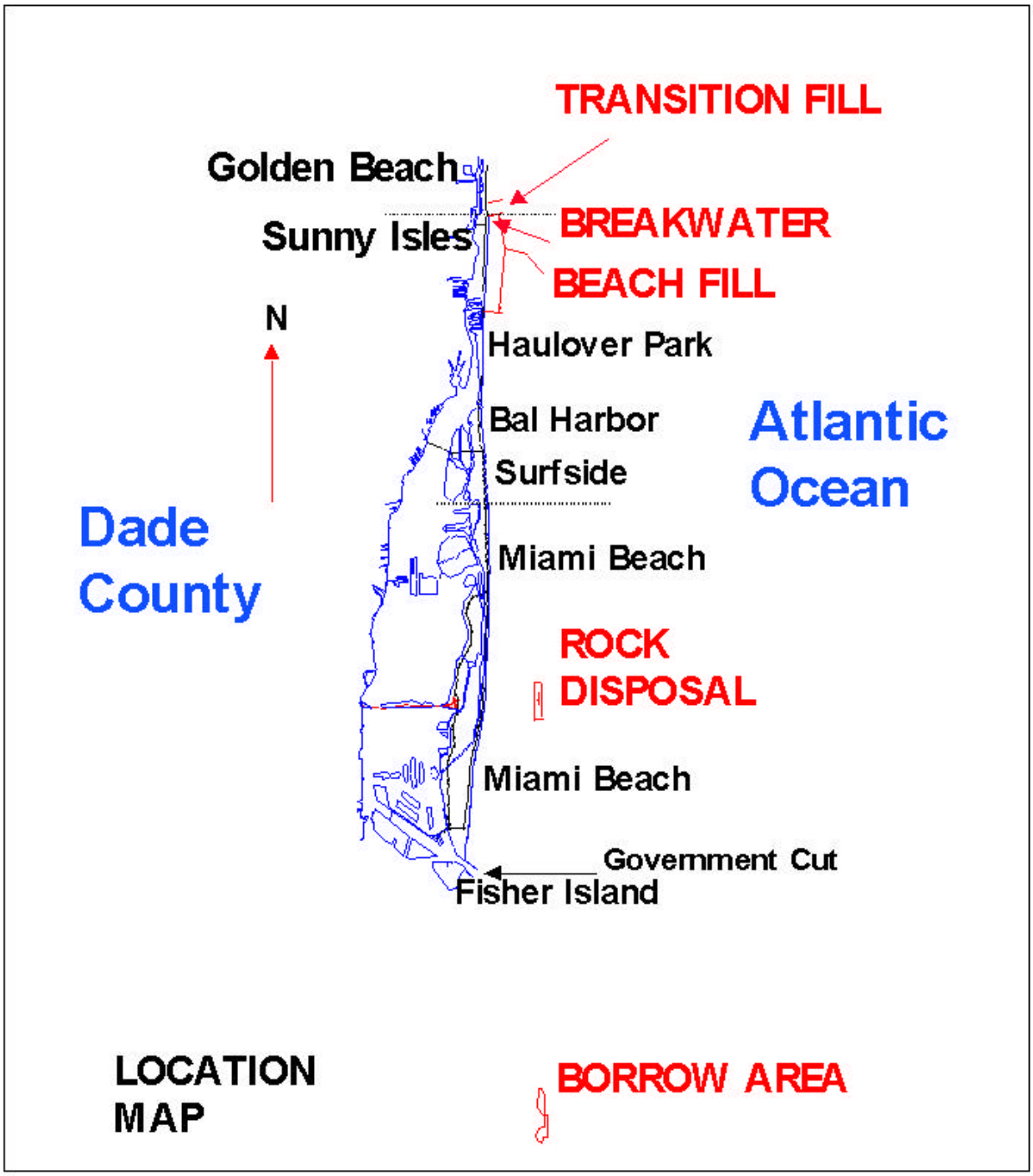
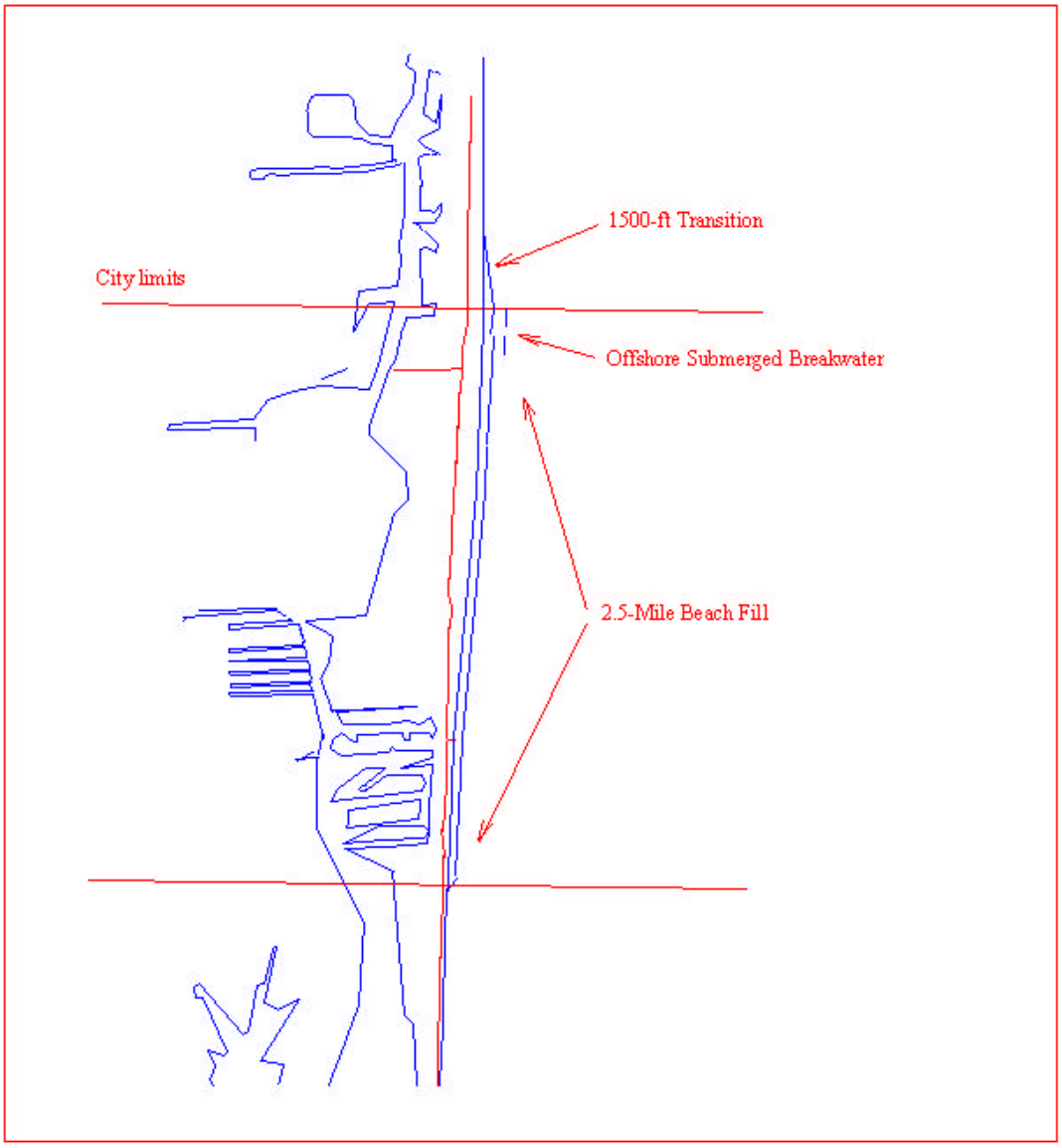

TRANSITION FILL
Golden Beach
Sunny Isles
BREAKWATER
BEACH FILL
N
Haulover Park
Bal Harbor
Atlantic Ocean
Surfside
Dade County
Miami Beach
ROCK DISPOSAL
Miami Beach
Government Cut
Fisher Island
LOCATION MAP
BORROW AREA

Figure 1

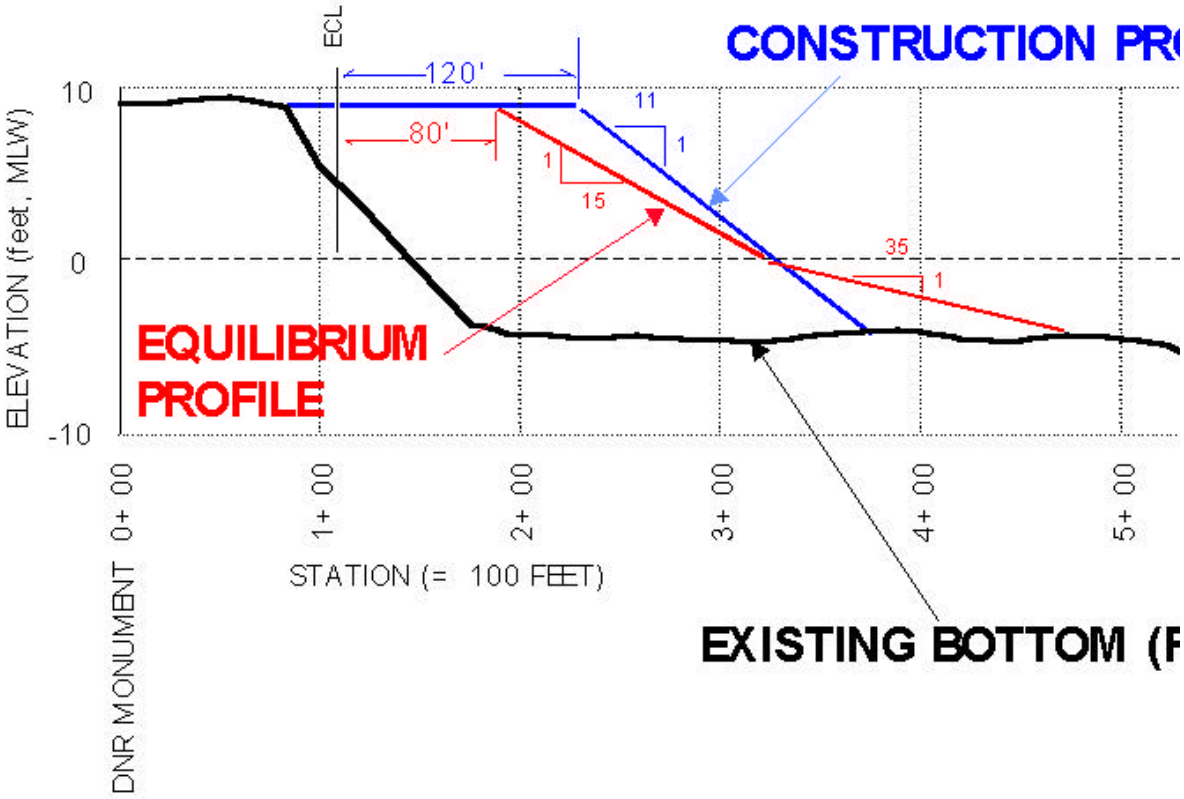


DADE COUNTY BEC & HP PROJECT

MODIFICATIONS AT SUNNY ISLES

PREFERRED ALTERNATIVE

FIGURE 2



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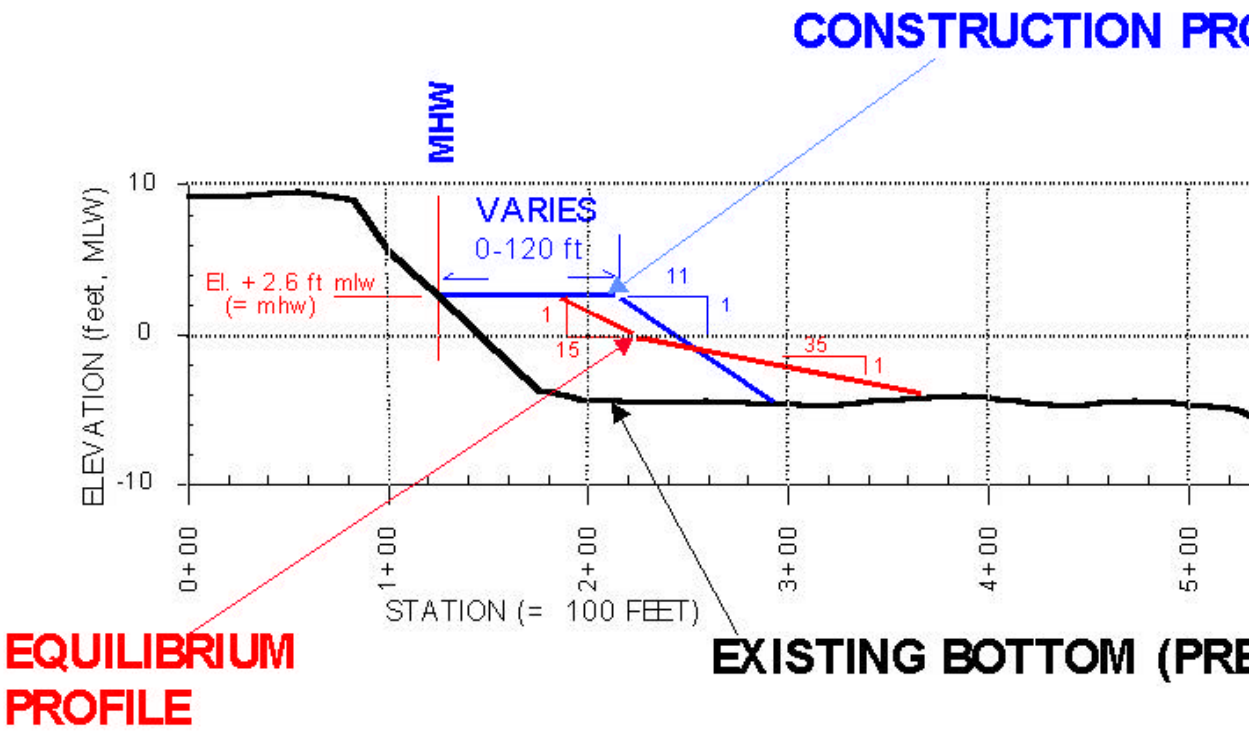
TYPICAL CROSS-SECTIO
BEACH RENOURISHMENT

Figure 3



TYPICAL CROSS-SECTION
(TRANSITION FILL, GOLDEN BEA

Figure 4

1.6 RELATED ENVIRONMENTAL DOCUMENTS.

The following is a list of related documents:

a. Dade County Beaches, Florida, Beach Erosion Control and Hurricane Surge Protection, General Design Memorandum, Phase I. U.S. Army Corps of Engineers, Jacksonville District, 1974.

b. Final Environmental Impact Statement, Beach Erosion Control and Hurricane Surge Protection Project, Dade County, Florida. U.S. Army Corps of Engineers, Jacksonville District, April 1975.

c. Beach Erosion Control and Hurricane Protection Study for Dade County, Florida, North of Haulover Beach Park, Survey Report and EIS Supplement. U.S. Army Corps of Engineers, Jacksonville District, June 1984.

d. Final Environmental Assessment, Second Periodic Nourishment, Sunny Isles and Miami Beach Segments, Beach Erosion Control and Hurricane Protection Project, Dade County, Florida. U.S. Army Corps of Engineers, Jacksonville District, May 1995.

e. Coast of Florida Erosion and Storm Effects Study, Region III, Feasibility Report with Final Environmental Impact Statement. U.S. Army

Corps of Engineers, Jacksonville District, October 1996.

f. Final Environmental Assessment, Beach Erosion Control and Hurricane Protection Project Dade County, Florida, Second Periodic Nourishment, Surfside and South Miami Beach Segments. U.S. Army Corps of Engineers, Jacksonville District, April 1997.

g. Dade County, Florida, Shore Protection Project, Design Memorandum, Addendum III, North of Haulover Park (Sunny Isles) Segment, U.S. Army Corps of Engineers, Jacksonville District, January 1995.

1.7 DECISIONS TO BE MADE.

This Environmental Impact Statement will evaluate whether to modify the Dade County BEC & HP Project, to provide additional shore protection measures to reduce spreading losses at the north end of the project and, if so, evaluate alternatives to accomplish that goal.

1.8 SCOPING AND ISSUES.

Scoping for the proposed project modification was initiated by a letter dated April 21, 1993. A Notice of Intent (NOI) to prepare a Draft Environmental Impact Statement appeared in the Federal Register on January 21, 1997 and an amendment appeared on April 7, 1997. Copies of the scoping letter and the NOI were distributed to the appropriate Federal, State and local agencies, appropriate city and county officials, and other parties known to be interested in the project. Copies of the scoping letter, NOI and amendment, the list of addressees used for distribution, and letters of response are included in Appendix C Pertinent Correspondence. A scoping meeting was held in Sunny Isles on September 23, 1997.

1.8.1 ISSUES EVALUATED IN DETAIL.

The following issues were identified during scoping and by the preparers of this Environmental Impact Statement to be relevant to the proposed action and appropriate for detailed evaluation:

a. Turbidity and sedimentation impacts to hardground/reef communities.

b. Monitoring of reefs adjacent to the borrow area for turbidity and sedimentation impacts.

c. Impacts on nesting sea turtles, nests, and hatchlings.

d. Mitigation.

e. Impacts on historic properties (i.e. historic shipwrecks).

f. Public safety.

g. Riparian property rights.

h. Water quality.

i. Recreation.

j. Endangered Species Act

k. Fish and Wildlife Coordination Act

l. Clean Water Act

m. Ocean Dumping Act

n. Rivers and Harbors Act

1.8.2 IMPACT MEASUREMENT.

The following provides the means and rationale for measurement and comparison of impacts of the proposed action and alternatives.

1.8.2.1 Hardground and Reef Impacts.

Based on extensive experience with beach renourishment and use of off-shore borrow in Dade County and other Florida beaches, impacts to hardground and reefs can be predicted based on proximity, currents, nature of borrow material, buffer zones and other factors. Our desire in selecting an alternative is to keep impacts to these resources to the minimum practicable in consideration of other project requirements.

1.8.2.2 Sea Turtles.

Sea Turtle nesting is closely monitored along Dade County's public beaches, including Sunny Isles. Detected nests are relocated to a safe hatchery. Impacts of compaction and scarps are fairly well established. In addition, continued beach erosion would reduce available nesting habitat. Corrective and mitigative protocols have been established. It is our goal to minimize impacts to sea turtles and to comply with the requirements of the Endangered Species Act.

1.8.2.3 Impact on Private Beach Property

Material placed in the transition fill off Golden Beach would be placed below mean high water in State owned water bottoms. Appropriate real estate rights for the project would be obtained from the state. Investigations conducted during the Coast of Florida Erosion and Storm Effects Study, Region III, indicate that the privately owned beach at Golden Beach is an accreting beach (due largely to capture of end losses from adjacent Federal projects). The accretional forces would likely be enhanced by the proposed project modification. Ownership of the newly accreted shoreline at Golden Beach is a concern expressed by some residents who desire to maintain private beach status. While this issue has no bearing on the likely success of the project for beach erosion control and hurricane protection, the implications of impact on property rights will be considered in making a decision on this project.

1.8.2.4 Public Safety.

A concern has been expressed over the safety of breakwaters to boaters, swimmers, and surfers. All these activities can be hazardous no matter where they take place. The proposed breakwaters would be appropriately marked to notice swimmers, boaters, and surfers in accordance with any Federal, state, and local requirements. The proposed breakwaters are not hard structures and would resemble a natural nearshore berm in many respects. Changes in wave and current patterns would result from the breakwater (as well as from the beach and transition fill). While the wave climate created by the breakwater may be an attractant, the safety of responsible boaters, swimmers, and surfers should not be compromised.

1.8.2.5 Other Impacts.

Bases for impact measurement and comparison are stated more specifically in section 4.0 on ENVIRONMENTAL EFFECTS and other sections of this document and its appendices.

1.8.3 ISSUES ELIMINATED FROM DETAIL ANALYSIS.

The following issues were not considered important or relevant to the proposed action based on scoping

and the professional judgment of the preparers of this Environmental Impact Statement:

The proposed action would not involve the disposal of dredged material or other substances subject to the Marine Protection Research and Sanctuaries Act (a.k.a. the Ocean Dumping Act). Material placed on the beach for beach renourishment and placement of rock fragments into an artificial reef or fish enhancement area is exempt. No other issues were specifically identified for elimination.

1.9 PERMITS, LICENSES, AND ENTITLEMENTS.

The proposed beach renourishment is subject to the Coastal Zone Management Act. Consultation with the State Historic Preservation Officer is also required. Since there would be a discharge of dredged or fill material into waters of the United States, the proposed Action is subject to Section 404 of the Clean Water Act. In addition the proposed action is subject to Section 401 of the Act for certification of water quality by the state. The U.S. Army Corps of Engineers, Jacksonville District, has submitted an application for a Section 401 Water Quality Certificate (WQC) from Florida Department of Environmental Protection (FDEP).

If conducted during the sea turtle nesting and hatching season, the proposed action will require daily sea turtle nest surveys and nest relocations. A permit from FDEP to handle sea turtles and relocate nests will be required for the person(s) performing the surveys and nest relocations associated with the proposed action. For the proposed renourishment at Sunny Isles, personnel from the Dade County Department of Parks and Recreation will be conducting the surveys and nest relocations.

The project sponsor, Dade County Department of Environmental Resources Management, is responsible for obtaining any real estate easements and rights of way required for this project.

2. ALTERNATIVES

The alternatives section is the heart of this EIS. This section describes in detail the no-action alternative, the proposed action, and other reasonable alternatives that were studied in detail. Then based on the information and analysis presented in the sections on the Affected Environment and the Probable Impacts, this section presents the beneficial and adverse environmental effects of all alternatives in comparative form, providing a clear basis for choice among the options for the decision maker and the public.

Several design alternatives were proposed to reduce the end losses of beach fills at the northern end of Sunny Isles. These alternatives included the placement of beach fills of varying widths, as well as the construction of submerged nearshore berms, beach fill transitions, and perched beaches. Structural options such as revetments, groins, offshore breakwaters, were also evaluated.

The numerical shoreline change model GENESIS (Generalized Model for Simulating Shoreline Change) was the primary tool used to evaluate the different alternative plans. The GENESIS model was executed using advanced nourishment berm widths of 50, 75, 100, and 125 feet. The effects of groin and breakwater construction were also evaluated. Several configurations of groins and breakwaters (and groin/breakwater combinations) were modeled using the existing (eroded) shoreline; the same structural configurations were then evaluated using the varying berm widths of 50 to 125 feet. The alternative plans were evaluated based on analyses of historic shoreline trends, numerical coastal modeling, analyses of costs and benefits, and effects on the environment. The recommended plan is the alternative that reduces the spreading (end) losses at the northern end of Sunny Isles in a manner that provides the greatest National Economic Development (N.E.D.) benefits.

2.1 DESCRIPTION OF ALTERNATIVES.

2.1.1 Beach renourishment with advanced nourishment

As a first step in modeling shoreline improvements, different berm widths (corresponding to different volumes of advance nourishment) were simulated along the length of Sunny Isles. Berm widths (in addition to the 20' design berm) of 50, 75, 100, and 125 feet were modeled throughout a 10-year simulation period. The 10-year simulation period corresponds to the design renourishment interval for the Sunny Isles project. High end losses at the northern end of the fill occurred in each case, with the wider fills showing higher initial losses. In each case, erosion into the design section occurred at the northernmost end of the project within the first year of fill placement. The rapid shoreline recession in this area corresponds with observed fill performance. This series of runs suggests that the renourishment interval cannot be adequately extended by placement of advance nourishment alone, and some additional means of reducing spreading losses is necessary.

2.1.2 Groins

This alternative to reduce end losses consisted of placing one or more groins near the north end of the fill. An initial series of modeling runs with 1, 2, and 3 groins demonstrated that groin construction without beach fill placement causes extreme downdrift erosion south of the structure(s). During the first year alone, the shoreline quickly receded to the seawall for more than 500 feet south of the groin(s). By the end of the 10-year simulation period, the beach had been completely eroded along as much as 1200 feet of shoreline. A new series of runs was made with the same single and multiple groins, in combination with the different berm widths described above in the beach nourishment alternative. Many configurations were used, with the numbers, positions, permeability, and lengths of the groins varying. All groin lengths discussed here are measured relative to the seawall, which is generally 20-30 feet west of the ECL along the northern 1200 feet of Sunny Isles.

The single-groin alternatives were positioned approximately 500 feet south of the Sunny Isles northern

city limit, in order to allow accretion on the north side of the structure along the most critical area of end losses. Although the 20-foot authorized berm width was generally maintained between the groin and the north city limit, for most groin lengths in excess of 200 feet serious downdrift (south) erosion persisted in each case. The downdrift deficit became greater for increasing groin lengths. For highly impermeable groins, erosion on the downdrift side of the structure receded through the design profile within 3 years, even for initial berm widths in excess of 100 feet. For highly permeable or very short groins, such as a 125-foot structure, the lack of a significant filet buildup on the north side resulted in some erosion into the design section within the first year. Downdrift erosion into the design section then followed, typically within 4 to 7 years. None of the single groin/beach fill combinations allowed a renourishment interval of 10 years to be achieved.

The next step involved the simulation of multiple groins. These simulations demonstrated that groin fields generally provided a more desirable shoreline response than a single groin. In each case involving the use of a single groin, the downdrift erosion was excessive for all but the shortest groin lengths, and these shorter lengths did not promote adequate accretion. The groin fields provided a more uniform berm width and smoother shoreline, as both accretion and downdrift erosion were spread over a wider area.

In order to provide a smoother beach planform and avoid serious downdrift erosion, a higher degree of permeability was assigned to each groin when using multiple structures. The greater bypassing through the groins allowed replenishment of the compartments between the groins, and allowed sediment to be transported to the downdrift beaches while still allowing the formation of an adequate fillet. The best shoreline response with a beach fill/groin combination was determined using a sensitivity analysis of groin lengths, positions, and permeabilities. This analysis resulted in a design consisting of 3 groins, spaced evenly along the northern 1200 feet of Sunny Isles. The northernmost groin was placed approximately 400 feet south of the city limit, with a gap of 375 feet between each structure. The length of each structure was 125 feet, and the permeability was 30 percent.

Multi-groin systems with up to 5 groins and varying lengths and permeabilities were also modeled. However, the 3-groin system remained the optimum groin configuration. It should be noted that during the simulations, only the northern 3 groins became exposed during a 10-year model simulation period. Therefore, the additional groins to the south represent an added cost, which provide no additional benefit.

Through field observations and GENESIS modeling it was found that the shoreline responded differently during different seasons. During the calmer summer months, the predominant incident wave direction shifts to the east and southeast. During these periods, the direction of sediment transport reverses and material accretes on the south side of the groins while eroding on the north side. During these periods of northerly transport, the downdrift erosion north of the groins adds to the effects of end losses from the north end of the fill, further increasing the loss of sediment from the fill area.

The use of a multiple-groin system provides a more favorable shoreline response than the single-groin alternative, since the shoreline exhibits a more smoothed response, and the design dimensions are maintained over a greater length of the project. However, the relatively large seasonal and spatial fluctuations in shoreline position caused by construction of a groin field along this reach persist. These effects are not desirable, since a primary objective of the proposed improvements is to stabilize the northern Sunny Isles shoreline and maintain the design cross-section over the entire project length during the 10-year renourishment interval. Therefore, constructing groins is not considered to be an acceptable alternative.

2.1.3offshore breakwaters

The use of offshore breakwaters was investigated as a means of providing greater seasonal shoreline stability. A wide range of breakwater configurations was simulated. Wave transmissibility was varied, as were offshore and alongshore breakwater locations. Single and segmented structures were modeled to determine optimum shoreline response. The optimum shoreline response was to provide a stable, wide berm at the northern project limit, with a renourishment interval of at least 10 years and no adverse

impacts to the adjacent shoreline.

Initial breakwater simulations indicated that beach fill placement would be required before construction of any breakwater, in order to avoid critical downdrift erosion. Without a prior beach fill placement, the shoreline south of the structure rapidly receded to the seawall along the northern portion of Sunny Isles, as southbound material was trapped during the initial salient formation. A salient is the seaward advance of the shoreline landward of the breakwater, which is created by the lower wave energy in the lee of the structure. A tombolo is formed when sand accretes to the point where the shore and the breakwater are connected. This effectively stops the littoral transport of sand and is not desirable. Placement of a substantial beach fill mitigated the erosive impacts during initial salient formation.

As stated previously, the most critical area of the project is the northernmost 1200 feet of Sunny Isles. Proceeding south of this area the ECL and the seawall line turn westward, and are generally offset much further landward of the water line. Breakwater locations were therefore limited to the northernmost 1200 feet of the Sunny Isles project, where erosional losses and shoreline recession are critical. Areas of widespread hardbottom exist off the Dade County shoreline; along northern Sunny Isles low profile hardbottom communities extend to within about 750 feet of the ECL. The presence of these hardbottom communities limit the seaward location of any structure to no more than about 700 feet east of the ECL.

A variety of structure lengths vs. distances offshore were simulated for both single and segmented breakwaters. Single breakwaters located nearshore were by necessity very short in order to prevent tombolo formation and allow sufficient bypassing. These structures did not provide protection to an adequate length of shoreline, as was demonstrated for the longer single structures. The most acceptable shoreline response was achieved with multiple-breakwater systems. Segmented breakwaters provided stability over a greater length of shoreline, and by properly sizing the gap between the structures, sufficient wave energy was allowed to pass through the gaps to prevent tombolo formation and allow adequate sand bypassing. A series of simulations on 2, 3 and 4 multiple breakwater systems was performed using the GENESIS model. The configuration that provided the best shoreline response at the most economical cost was a two-breakwater system, consisting of two 375-foot segments, separated by a 250-foot gap. The structure centerline is located 480 feet from the ECL (500 feet from the shoreline) in about 8 feet of water. Model simulations indicated a renourishment interval of almost 10 years, with the construction of the breakwater and a 100-foot advance nourishment berm.

The structure is designed to withstand wave forces due to 10-year storm conditions. The maximum deepwater hindcast wave height for a 10-year recurrence interval is 5.83 meters (19 feet). However, at the breakwater location a depth-limited wave corresponding to a 10-year water level of 5.3 feet would be 10.3 feet high. According to the Hudson equations presented in the Shore Protection Manual, the median armor stone size required to withstand 10.3-foot waves is 12 tons. Due to the shallow water depth and low crest elevation of the structure, excavation would be required in order to construct a foundation layer, and only one layer of stone could be placed without further excavation.

A rubble-mound breakwater was originally proposed during initial plan formulation. During coordination with State of Florida environmental permitting agencies, serious concerns were raised by the State concerning the construction of "hard" structures offshore, and permitting of such structures was considered at that time to be difficult, if not impossible. During subsequent consultations with the State of Florida it was determined that the construction of "soft" solutions, including beach fills and possibly geo-textile tubes, were regarded much more favorably by permitting agencies due to the smaller construction footprint and due to the fact that such a structure could be removed relatively easily if required. Placement of this structure would be accomplished as part of the innovative coastal technologies program.

Due to the shallow-water conditions at the construction site and the difficulty of constructing a rubble-mound structure, alternative methods of breakwater construction were investigated. The use of geo-textile tubes and concrete breakwater units were investigated as an economical alternative to rubble-mound structures. Geo-textile tubes are available in a wide variety of sizes and cross-sectional shapes, and have been used successfully in a variety of coastal applications throughout the world. Concrete breakwater units are also available in a wide variety of configurations, all typically triangular or

trapezoidal in cross-section. Several types of patented pre-cast concrete breakwater units are available.

Two breakwaters have been constructed using prefabricated concrete breakwater units in Palm Beach County, Florida, located approximately 60 miles north of Sunny Isles. The breakwaters, placed in 1988 and 1993, have been monitored extensively for shoreline response as well as structural settlement and biological effects. The structure placed in 1988 is located approximately 7.5 miles south of Lake Worth Inlet, off Palm Beach. The structure is 600 feet long and is located about 175 feet offshore in 8 feet of water (mlw). A permit was issued by the Florida Department of Natural Resources (FDNR), now the Department of Environmental Protection (FDEP), based on the project being monitored as an experimental method of shore protection. The permit specified standards of performance for the structure, and stated that removal of the breakwater would be required if the breakwater did not perform as specified in the permit. Following 6 years of monitoring, the FDEP concluded that the structure did not meet the required standards and should be removed.

A second prefabricated breakwater was constructed in August 1993. This breakwater was 4176 feet long and placed approximately 300 feet from shore, along the Midtown portion of Palm Beach. The structure was located in about 8 feet of water (mlw). Extensive monitoring was also performed at this structure. Preliminary results show that settlement of the concrete units has averaged 2.6 feet since construction, with a total final settlement of 3 feet predicted. Accretion west of the structure was measured at 13,289 cubic yards during the first 4 months following structure placement. Some additional accretion was measured downdrift (south) of the structure, and erosion was measured to the north.

Some of the potential problems with the use of prefabricated concrete breakwaters, as noted in the two case studies in Palm Beach County, include the tendency for the heavy concrete units to settle several feet and scour the bottom around and between the units. They also create "hard" obstructions to navigation and pose a potential danger to bathers if located too close to shore. During monitoring of these two structures, only marginal shoreline accretion was observed. The FDEP has expressed serious reservations about permitting the construction of additional prefabricated concrete breakwaters, pending a more long-term study of the effects of these structures.

The use of geo-textile structures for offshore breakwater construction is relatively new in the United States. Geo-textile tubes have been used extensively for the construction of upland structures such as revetments, where they have provided effective protection of upland property and structures at a relatively low cost. Geo-textile tubes have been used in a variety of other applications, including construction of dikes, wharfs, and groins. Other advantages to the use of geo-textile products are the relative simplicity of the design and, in most cases, ease of construction. These structures may have a relatively long life in suitable environments, but may be more easily removed than traditional "hard" structures, if required.

The use of geo-textile tubes has been documented in several locations throughout the world, most notably along the Belgian coast in the North Sea. A system of tubes was placed along that shoreline in an overlapping groin/breakwater configuration, and backfilled with sand. The resulting beach renourishment exhibited far greater stability than previous fills using beach fill alone.

The use of geo-textile tubes is ideally suited for the Sunny Isles project. The tubes could be easily placed within the small design cross-section required, and the initial cost of the structures (generally estimated at approximately $200/linear foot) is much less than the cost of constructing traditional rubble-mound breakwaters. The tubes would also pose less of a hazard to bathers and boaters than a riprap structure, and could be removed relatively easily if required. Additionally, such "soft" shoreline stabilization measures are generally considered to cause fewer adverse environmental impacts than rubble-mound structures, and are more likely to be permitted than hard structures. Because of the inherent difficulties of constructing a rubble breakwater, and due to the advantages presented by the use of geo-textile structures in this location, the use of geo-textile tubes is recommended for the construction of the segmented offshore breakwater at Sunny Isles.

2.1.4 BEACH FILL TRANSITIONS

The use of beach fill transitions on the north end of the Sunny Isles beach fill was also investigated using the GENESIS numerical model. Transition lengths simulated, ranged from zero to the full length of Golden Beach, with intermediate lengths of 250, 500, 750, 1000, 1500, 2000, and 3000 feet. Beach fill performance was simulated for 10-year periods for berm widths of 50, 75, 100, and 125 feet for each of the transition lengths. Model results lead to several conclusions. First, as noted during actual project monitoring, end losses are excessive when no structure and no transition are placed. Second, advance nourishment berm widths of at least 75 feet (95 feet overall from ECL) are required to maintain a 10-year renourishment interval at the northern end of Sunny Isles, for the longer transition lengths. Third, transition lengths greater than 1500 feet provide little additional reduction of spreading losses. The GENESIS analysis showed that average annual end losses decrease by approximately 50 percent with a 1500-foot beach fill transition in place, but that at the extreme northern end of the project, the shoreline still recedes more rapidly than the rest of the beach fill due to spreading losses.

In an attempt to further stabilize the northern end of the fill, the use of beach fill transitions in combination with the segmented breakwater design were simulated using the GENESIS model. The results showed the most favorable shoreline response of any model simulation. The transition served two functions: to reduce the discontinuity in berm widths between Golden Beach and Sunny Isles, and to provide advance fill for salient formation behind the breakwater. The placement of a 100-foot advance maintenance berm, 1500-foot beach fill transition, and the two 375-foot segments of the offshore breakwater resulted in a stable berm landward of the segmented breakwater with a renourishment interval of 10.6 years. GENESIS simulations indicated that even without the offshore breakwaters at the northern end of Sunny Isles, renourishment intervals of about 7 years are possible by constructing the 100-foot advance maintenance berm and 1500-foot transition.

2.1.5 Alternative sand sources

2.1.5.1 Borrow Areas South of Government Cut

Three potential borrow areas south of Government Cut have been or are being developed for future renourishment of the Dade County BEC&HP Project. These borrow areas are located about 2 miles east of Key Biscayne in about 35 to 45 feet of water and are situated between two harground/reef communities. The sites have been designated SGC borrow area, SGC-2 borrow area, and SGC borrow area extension. To protect reef communities each borrow area has been designed to have a buffer zone of at least 400 feet from any hardground area. The borrow areas have also been designed to avoid four potentially significant cultural resources identified in the vicinity. Sand from these areas is generally light gray, poorly graded carbonate sand with a trace of silt and gravel sized shell fragments. In the SGC borrow area the silt content ranges from 2.0 to 11.0 percent with an average of 6.1 percent. The composite mean grain size is 0.44 mm. Carbonate rock fragments occur within the borrow area and it is estimated that up to 10 percent of the borrow area may be rock fragments from 1 inch to 3 feet in diameter. Silt content in the SGC-2 borrow area ranges from 1.3 to 10.3 percent with an average of 4.5 percent. The composite mean grain size is 0.56 mm. In the SGC extension borrow area the silt content ranges from 0.8 to 9.2 percent with an average of 3.7 percent. The composite mean grain size is 0.62 mm. In both the SGC-2 and SGC extension, rock fragments from 1 inch to 3 feet in diameter may make up to 5 percent of the material in the borrow area. The use of these borrow areas will require that all rock fragments larger than 1 inch be separated from the sand and disposed of in an approved area offshore. All three borrow areas represent high quality beach nourishment sand sources that contain a low amount of silt.

The SGC borrow area has been identified and developed as the source of sand for the upcoming 2nd renourishment at Surfside and South Miami Beach. This renourishment is expected to take place during 1998 and will utilize all the accessible sand in the borrow area. Therefore, this borrow area will not be available as a sand source for the proposed project at Sunny Isles.

2.1.5.2 Deep Water Sand Sources

Technology may be available for dredging deep water sand sources (60 to 300 feet deep). However we have no information on the cost, location, quantity, suitability, or environmental impacts associated with such dredging. It is unlikely that this information will be available for the proposed project.

2.1.5.3 Distant Domestic Sand Sources

Non-local offshore sources of sand (sand located outside the immediate Dade County area) are discussed here as an alternative to the proposed borrow area. This sand could come from other areas within Florida or perhaps outside the state. According to investigations conducted during of the Coast of Florida Erosion and Storm Effects Study, Region III, a substantial amount of sand lies off the coast of Palm Beach County (estimated at 655,025,947 cubic yards). The renourishment needs of the Palm Beach County Shore Protection Project is estimated at 26,253,000 cubic yards of material over the next 50 years [except the Delray segment (28 years) and Boca Raton segment (43 years)]. Although the use of distant sources causes an increase to project costs, the inadequate supply of sand in Dade County will result in the use of alternate sources in the future. However, Palm Beach County has objected to the use of sediment deposits offshore of Palm Beach County for beach nourishment projects in Dade County. Refer to letter dated 25 April 1995, from the Director of the Department of Environmental Resources Management for Palm Beach County in Appendix C.

There would be impacts associated with using any offshore source. These effects would be similar to those expected to occur at the SGC-2 and SGC extension borrow areas. At this time, the increased costs as a result of longer hauling distance is not justified by the minor nature of the impacts anticipated by using these two borrow areas.

2.1.5.4 Foreign Sand Sources

Calcium carbonate sands are found extensively off the coast of the Bahamas and have been identified as a potential sand source for the Dade County project. These aragonite sand deposits contain only trace amounts of silt or clay sized material. The mean grain size ranges from 0.25 mm to 0.29 mm and is moderately sorted. The specific gravity of oolitic aragonite ranges from 2.75 to 2.88, compared to 2.65 for quartz sand. Being more dense, oolitic aragonite behaves hydraulically as larger sized quartz grains. Aragonite's higher specific gravity and well rounded texture of the grains cause oolite sand to have a hydraulic equivalent mean grain size of 0.34 mm. Another potential sand source may exist around the Turks and Caicos Islands. This sand is similar in characteristics to the Bahamian sand. The Corps is currently looking into the possibilities of using these sands for beach renourishment, however they are not available for use at this time.

Carbonate sand from the Bahamas or the Turks and Caicos is a promising resource for future nourishment projects, however, our experience and knowledge is limited concerning the physical, engineering, and biological properties of the sand as beach fill. There is sufficient uncertainty about the impacts of using foreign sand on sea turtles and for the introduction of exotic organisms, that large scale use of foreign sand is not appropriate without proper scientific evaluation. Processed and stockpiled aragonite has been used on a limited basis for a small beach nourishment at Fisher Island. However, large scale use of raw aragonite or other foreign sand on a large reach of a sea turtle nesting beach is not acceptable to the U.S. Fish and Wildlife Service (USFWS) and the Florida Department of Environmental Protection (FDEP) without further study and testing.

The Corps, through the Waterways Experiment Station and in consultation with the USFWS, FDEP and Dade County Department of Environmental Resources Management (DERM) have begun studies to determine the potential impacts of foreign carbonate sand on sea turtles. The current studies are being conducted in the Dade County Sea Turtle Hatchery in Miami Beach using different sand types including, native beach, renourished, upland, and aragonite sands. The parameters being studied include nest temperatures, nest sex ratios, and nest hatching success. If the results from these studies indicate there is no significant effect to sea turtles, a test beach will be constructed using a foreign source of sand. Additional studies will be conducted on the test beach to determine engineering properties of the sand and effects on sea turtle nesting behavior and impacts to beach benthic infaunal communities. In situ nest studies will also be conducted to determine effects on hatching success and hatchling sex ratios. If

the test beach does not indicate any serious problems with the foreign sand source, larger scale use as beach fill could follow upon approval by the USFWS and FDEP. The current schedule for construction of the test beach is the spring of 1999. The use of foreign sand will be evaluated pursuant to NEPA. This includes not only its general use as beach fill material but also the placement of a test beach**.** Until the proper evaluations have been completed and approvals obtained, the use of foreign sand for renourishing Sunny Isles is not an acceptable alternative.

2.1.5.5 Upland Sand Source

Test results on native beach materials and sands available from commercial upland sand quarries indicate that, in most cases, the upland sand sources are texturally very compatible with little or no overfill required. Upland sand quarries are located on the Lake Wales Ridge of the Central Highlands physiographic region of south Florida. One upland source area is located southwest of Lake Okeechobee, at Ortona, Florida. There are presently two quarries at Ortona, and barge canal access to the Okeechobee Waterway is accessible to both quarries. The material from these two quarries consists of clean, medium to fine grained quartz sand that have a mean grain size range of 0.48 mm to 0.55 mm with generally less than 5 percent silt content. This alternative would involve the transporting sand from a quarry site, by either barge or railroad cars, to an appropriate offloading site near the project location. The sand would then be loaded onto dump trucks and then hauled to the beach and dumped at beach access points along the fill site. From these beach stockpiles, the material would be distributed along the beach by earthmoving equipment. Because of the potential to damage bridges, the dump trucks would most likely be limited to a maximum capacity of 12 cubic yards. With an estimated volume of 988,000 cubic yards of sand needed to complete the project, this would require over 82,333 truck loads. The use of larger dump trucks (i.e. 16 to 18 cubic yards), if allowed, would reduce the number of loads but would still be substantial. This would have a significant adverse impact on the traffic within the project area and areas adjacent to the project. There would also be an increase in the noise levels associated with trucking sand to the project site. In addition, vibrations caused by the trucks could damage structures that are located close to the roadways being used. The use of large numbers of trucks would also cause extensive damage to the roads used. This would require that the roads be repaired after construction has been completed. Barging in the sand and piping a slurry to shore (or over land) has been considered. However, the technical/logistical problems with this have not been resolved. In addition, the mobilization and demobilization costs of for constructing a discharge pipeline to the beach would add to an already costly alternative.

2.1.6 NO ACTION ALTERNATIVE (STATUS QUO)

With the no action alternative, the present condition of rapid erosion due to spreading losses at the north end of Sunny Isles would continue. The no action plan does not provide a solution to the increased erosion occurring at the north end of Sunny Isles. It is expected that interim renourishments would be needed, along this section of beach, at 2-year intervals to provide the protection for which the project was designed. This would amount to four interim renourishments between each of the full project renourishments, which are scheduled to occur every 10 years.

2.2 ISSUES AND BASIS FOR CHOICE

The alternative plans were evaluated based on analyses of historic shoreline trends, numerical coastal modeling, analyses of costs and benefits, and effects on the environment. The recommended plan is the alternative that reduces the spreading (end) losses at the northern end of Sunny Isles in a manner that provides the greatest National Economic Development (N.E.D.) benefits.

2.3 PREFERRED ALTERNATIVE

The optimum plan of improvement consists of constructing a 100-foot wide advance maintenance berm, constructing a segmented offshore breakwater, and constructing a 1500-foot beach fill transition into Golden Beach. A total volume of approximately 988,000 cubic yards of material will be required to construct the beach fill and transition, and to fill the geo-textile breakwater tubes. The source for this material will be borrow areas south of Government Cut designated SGC-2 and SGC extension. The

recommended plan is shown in figure 2. At this time the preferred breakwater structure would be constructed of sand filled geo-textile tubes. However, a rubble mound structure is still being considered. If, in the future, it is decided to construct a rubble mound breakwater instead of using geo-textile tubes, this EIS would be supplemented With an Environmental Assessment (EA). If the EA concludes in a Finding of No Significant Impact, it would be circulated for a 30-day public review and comment period.

2.4 ALTERNATIVES ELIMINATED FROM DETAILED EVALUATION

Other alternatives considered included the construction of revetments and perched beaches. Revetments were not considered to be an acceptable solution because they function only to protect upland property that is already well armored, and will provide no additional protection to the project beach. Construction of a perched beach would result in the creation of a steep underwater drop-off in the nearshore beach profile. Sunny Isles is a heavily used recreational beach, and the adverse impacts of a perched beach on public safety made this option unacceptable.

2.5 ALTERNATIVES NOT WITHIN JURISDICTION OF LEAD AGENCY

To the Corps' knowledge, there are no alternatives that are not within the jurisdiction of the lead agency.

2.6 COMPARISON OF ALTERNATIVES

Table 1 lists alternatives considered and summarizes the major features and consequences of the proposed action and alternatives. See section 4.0 Environmental Effects for a more detailed discussion of impacts of alternatives.

2.7 MITIGATION

Mitigation for hardground impact due to the placement of the discharge pipeline would be performed as part of this proposed project. Mitigation would be accomplished by constructing and artificial reef with either limestone boulders or prefabricated reef modules, similar to what was conducted for the 1997 renourishment at Sunny Isles and Miami Beach. A specific mitigation plan would be developed in coordination with the Florida Department of Environmental Protection, Dade County Department of Environmental Resources Management and the U.S. Army Corps of Engineers. Borrow area design will ensure sufficient buffer areas (presently planned at 400 feet) to minimize impacts from turbidity, sedimentation and mechanical damage on offshore hardground communities. Precision positioning of equipment, with a Geographic Positioning System (GPS), will aid in avoiding sensitive areas. The protection of potentially significant historical properties, located in the vicinity of the borrow areas will be accomplished by establishing adequate buffer areas around the identified anomalies. Refer to Section 4.12 Historic Properties. Section 4.26 Environmental Commitments, discusses other procedures that will be implemented to avoid or minimize potentially adverse environmental impacts.

Table 1: Summary of Direct and Indirect Impacts for Alternative Project Plans Considered.

ALTERNATIVE ENVIRONMENTAL FACTOR	BEACH RENOURISHMENT	GROINS	OFFSHORE BREAKWATERS	BEACH FILL TRANSITIONS	RECOMM
PROTECTED SPECIES	no impact on manatees or whales expected; beach fill activities could impact sea turtle nesting or hatching.	no impact on manatees or whales; construction activities could impact sea turtle nesting or hatching if performed during nesting season.	no impact expected.	no impact on manatees or whales; construction activities could impact sea turtle nesting or hatching.	no impac whales e activities turtle nes

HARD GROUND	temporary increase in turbidity and sedimentation rates over nearshore hardground communities.	no impact expected	temporary increase in turbidity and sedimentation rates over nearshore hardground communities.	temporary increase in turbidity and sedimentation rates over nearshore hardground communities.	temporar turbidity a rates ove hardgrou
EFFECTS ON ADJACENT SHORELINE EROSION	with beach renourish-ment alone, the northern 1200 ft of Sunny Isles will continue to erode at a rapid rate due to end losses.	shoreline expected to accrete immediately north of the groin(s); significant erosion to the beach would occur south of the groin(s).	construction of breakwater without a beach fill would cause erosion of the beach on both sides of the breakwater.	with the transition fill alone, the northern 1200 ft of Sunny Isles will continue to erode at a slightly reduced rate.	will stabil of Sunny for a 10-y cycle.
FISH AND WILDLIFE RESOURCES	temporary affect on benthic organisms at beach fill site - beach habitat improved.	temporary affect on benthic organisms at construction site.	temporary affect on benthic invertebrates within breakwater footprint.	temporary affect on benthic organisms at fill site.	same ten noted for of the rec
VEGETATION	no seagrass beds present within beach fill area; no impact.	no seagrass beds present; no impact.	no seagrass beds present; no impact.	no seagrass beds present; no impact.	no seagra no impac
WATER QUALITY	temporary increase in turbidity and suspended sediments within the immediate vicinity of the beach fill.	temporary increase in turbidity and suspended sediments during groin construction .	temporary increase in turbidity and suspended sediments during construction.	temporary increase in turbidity and suspended sediments at fill site.	temporar turbidity a sediment beach fill
HISTORIC PROPERTIES	no impact expected	no impact expected	no impact expected	no impact expected.	no impac
ECONOMICS	when compared to recommended plan, would require more frequent renourishments at north end to maintain protection; thus, higher costs.	when compared to recommended plan, would require more frequent renourishments at north end to maintain protection; thus, higher costs.	when compared to recommended plan, would require more frequent renourishments at north end to maintain protection; thus, higher costs.	when compared to recommended plan, would require more frequent renourishments at north end to maintain protection; thus, higher costs.	reduced of the pro
ENERGY REQUIREMENTS & CONSERVATION	compared to the recommended plan, there would be an increase in energy usage from more frequent renourishments.	compared to the recommended plan, there would be an increase in energy usage from more frequent renourishments.	compared to the recommended plan, there would be an increase in energy usage from more frequent renourishments.	compared to the recommended plan, there would be an increase in energy usage from more frequent renourishments.	lower whe each alte

Table 1 (Continued): Summary of Direct and Indirect Impacts for Alternative Project Plans Considered.

Table 2: Summary of Direct and Indirect Impacts for Alternative Sand Sources Considered.

ALTERNATIVE ENVIRONMENTAL FACTOR	BORROW AREAS SOUTH OF GOVERNMENT CUT	DEEP WATER SAND SOURCES	DISTANT DOMESTIC SAND SOURCES	FOREIGN SAND SOUR
PROTECTED SPECIES	no impact on manatees , whales, or sea turtles expected from dredging borrow area	impacts not determined; additional site specific investigations needed.	no impact on manatees , whales, or sea turtles at borrow area expected.	impacts from dredging potential effect on sea from beach fill
HARDGROUND	potential sedimentation, turbidity and mechanical effects near borrow areas; impacts to hardgrounds from pipeline placement.	impacts from pipeline placement; investigations needed to determine potential impacts at borrow area.	potential sedimentation, turbidity and mechanical effects near borrow areas; impacts to hardgrounds from pipeline placement.	potential impacts at bor unknown; impacts to hardgrounds from pipeli placement.
EFFECTS ON ADJACENT SHORELINE EROSION	no effect expected	no effect	not determined; depends on site.	no effect
FISH AND WILDLIFE RESOURCES	temporary affect on benthic organisms within borrow area	effects unknown, further investigation is needed.	temporary affect on benthic organisms within borrow area	effects unknown, furthe specific investigations needed.
VEGETATION	no seagrass beds present in borrow area; no impact.	no impacts expected	unknown at this time; could impact seagrasses if present in vicinity of borrow area.	unknown at this time; c impact seagrasses if p vicinity of borrow area.
WATER QUALITY	temporary increase in turbidity and suspended sediments within borrow area.	temporary increase in turbidity and suspended sediments within borrow area.	temporary increase in turbidity and suspended sediments within borrow area.	temporary increase in t and suspended sedime borrow area.
HISTORIC PROPERTIES	no impact expected	not determined	not determined	not determined
ECONOMICS	uses nearby more economical sand source.	higher costs in comparison due to longer transporting distances.	generally higher costs in comparison due to longer transporting distances.	higher costs in compari associated with longer transporting distances.
ENERGY REQUIREMENTS & CONSERVATION	smaller energy use in comparison to other sand source alternatives.	higher in comparison to proposed borrow area due to longer transporting distances.	generally higher in comparison to proposed borrow area due to longer transporting distances.	higher in comparison to proposed borrow area d longer transporting dist

3. AFFECTED ENVIRONMENT

The Affected Environment section succinctly describes the existing environmental resources of the areas that would be affected if any of the alternatives were implemented. This section describes only those environmental resources that are relevant to the decision to be made. It does not describe the entire existing environment, but only those environmental resources that would affect or that would be affected by the alternatives if they were implemented. This section, in conjunction with the description of

the "no-action" alternative forms the base line conditions for determining the environmental impacts of the proposed action and reasonable alternatives.

3.1 GENERAL ENVIRONMENTAL SETTING

The shoreline along Sunny Isles is lined with hotels, condominiums, and other commercial establishments. The area is used extensively for recreation.

3.2 VEGETATION

The dune system in Dade County between Government Cut and Bakers Haulover Inlet is largely artificial and was built as part of the Dade County BEC & HP Project. Dominant plant species in the dune communities include sea grapes, *Coccoloba uvifera*; the beach morning glory, *Ipomoea pes-caprea*; beach bean, *Canavalia rosea*; sea oats, *Uniola paniculata*; dune panic grass, *Panicum amarulum*; bay bean, *Canavalia maritima.* The beach berry or inkberry, *Scaevola plumieri;* sea lavender, *Mallotonia gnaphalodes*; spider lily, *Hymenocalis latifolia*; beach star, *Remirea maritima*; and coconut palm, *Coco nucifera* are also present. There is no appreciable dune system within Sunny Isles, due to extensive shoreline development.

Algal coverage on the offshore hardground areas fluctuates seasonally. The most common algal species observed within southeast Florida offshore hardground areas are *Caulerpa prolifera*, *Codium isthmocladum*, *Gracillaria* sp., *Udotea* sp., *Halimeda* sp., and various members of the crustose coralline algae of the family Corallinaceae. Algal growth is most luxuriant from late July through late October or early November. There seems to be a particular burst or bloom in the macroalgal population in conjunction with the seasonal upwelling that occurs in late July or early August (Smith, 1981, 1983; Florida Atlantic University and Continental Shelf Associates, Inc., 1994).

Seasonally, there is extensive macroalgal growth in the offshore soft bottom areas, with species of green algae (*Caulerpa* sp., *Halimeda* sp., and *Codium* sp.) being particularly abundant in the summer and the brown algal species (*Dictyota* sp. and *Sargassum* sp.) being more abundant in the winter (Courtenay *et al*., 1974; Florida Atlantic University and Continental Shelf Associates, Inc., 1994). The sea grass *Halophila decipiens* has been observed offshore of Dade County, but is considered seasonal (April through November) in these offshore soft bottom areas.

3.3 THREATENED AND ENDANGERED SPECIES

3.3.1 SEA TURTLES

Sea turtles are present in the open ocean year-round offshore of Dade County because of warm water temperatures and hardbottom habitat used for both foraging and shelter. The predominant species is the loggerhead sea turtle, *Caretta caretta*, although green turtles, *Chelonia mydas*; leatherback turtles, *Dermochelys coriacea*; hawksbill turtles, *Eretmochelys imbricata*; and Kemp's ridleys, *Lepidochelys kempii* are also known to exist in the area. All the sea turtles except for the loggerhead are listed as endangered. The loggerhead is listed as threatened.

Loggerhead nesting in Dade County occurs from late April through September (Meylan et. al., 1995). The density of nesting along the Dade County shoreline north of Government Cut is relatively low. The frequency of nesting along the beach at Sunny Isles has ranged from 9 nests in 1989 to 24 nests in 1997 with the highest occurring in 1995 at 35 nests (DERM 1997, unpublished nesting data). The number of false crawls ranged from 44 in 1989 to 24 in 1997. The lowest number of false crawls occurred in 1993 at 7 with the highest occurring in 1989. For Golden Beach nesting ranged from 45 nests in 1987 to 28 nests in 1992 (Meylan et. al., 1995). The highest number of nests for Golden beach occurred in 1991 with 80 nests. The number of false crawls in Golden Beach ranged from 11 in 1987 to 9 in 1992. The highest number of false crawls occurred in 1990 with 17 and the lowest occurred in 1992 with 9. The loggerhead accounts for the majority of the nesting in the county with occasional nesting by green and leatherback turtles. Leatherback turtles may start nesting earlier than loggerheads. In Dade

County the earliest nest documented by Meylan et. al., 1995, was on April 11, 1992. During the sea turtle nesting season, the Dade County Park and Recreation Department conducts daily surveys (commence on April 1) and relocates nests found along the beach from Sunny Isles south to Government Cut. This is done to prevent poaching or nest destruction due to beach maintenance, emergency vehicles which access the beach and other human related causes (Flynn 1992). All nests found during the surveys are relocated to a central hatchery on Miami Beach (pers. comm., B. Flynn, Dade Co. Dept. of Env. Res. Mgmt., 1993). Turtle nests laid on the beach within the Town of Golden Beach are not surveyed by the county and are not routinely relocated, but are allowed to remain on the beach.

3.3.2 WEST INDIAN MANATEE

The estuarine waters around the inlets and bays within Dade County provide year-round habitat for the West Indian manatee, *Trichecus manatus*. Although manatees have been observed in the open ocean, they feed and reside mainly in the estuarine areas and around inlets. No significant foraging habitat is known to exist in the areas around the project sites, nor have manatees been known to congregate in the nearshore environment within the project area.

3.3.3 other threatened endangered species

Other threatened or endangered species that may be found in the in the coastal waters off of Dade County during certain times of the year are the finback whale, *Balaenoptera physalus*; humpback whale, *Megaptera novaeangliae*; right whale *Eubalaena glacialis*; sei whale, *Balaenoptera borealis*; and the sperm whale *Physeter macrocephalus catodon*. These are infrequent visitors to the area and are not likely to be impacted by project activities.

3.4 FISH AND WILDLIFE RESOURCES

3.4.1 BEACH and offshore sand bottom communities

The beaches of southeast Florida are exposed beaches and receive the full impact of wind and wave action. Intertidal beaches usually have low species richness, but the species that can survive in this high energy environment are abundant. The upper portion of the beach, or subterrestrial fringe, is dominated by various talitrid amphipods and the ghost crab *Ocypode quadrata*. In the midlittoral zone (beach face of the foreshore), polychaetes, isopods, and haustoriid amphipods become dominant forms. In the swash or surf zone, coquina clams of the genus Donax and the mole crab Emerita talpoida typically dominate the beach fauna. All these invertebrates are highly specialized for life in this type of environment (Spring, 1981; Nelson, 1985; and U.S. Fish and Wildlife Service [USFWS], 1997).

Shallow subtidal soft bottom habitats (0 to 1 meters [0 to 3 feet] depth) show an increasing species richness and are dominated by a relatively even mix of polychaetes (primarily spionids), gastropods (*Oliva* sp., *Terebra* sp.), portunid crabs (*Arenaeus* sp., *Callinectes* sp., *Ovalipes* sp.), and burrowing shrimp (*Callianassa* sp.). In slightly deeper water (1 to 3 meters [3 to 10 feet] depth) the fauna is dominated by polychaetes, haustoid and other amphipod groups, bivalves such as *Donax* sp. and *Tellina* sp. (Marsh *et al*., 1980; Goldberg *et al.*, 1985; Gorzelany and Nelson, 1987; Nelson, 1985; Dodge *et al*., 1991.

Offshore soft bottom communities are less subject to wave-related stress than are nearshore soft bottom communities. They exhibit a greater numerical dominance by polychaetes as well as an overall greater species richness than their nearshore counterparts. Barry A. Vittor & Associates, Inc. (1984) reported polychaetes made up 68.9 percent of the macrobenthic community off Port Everglades, followed by mollusca (13.2 percent), arthropods (10.7 percent), echinoderms (1.2 percent), and miscellaneous other groups (6.0 percent). Goldberg (1985) reported polychaetes as the dominant taxon from his infaunal survey off northern Broward County. Dodge *et al.* (1991) found polychaetes to be the most abundant group in 18 meters (60 feet) of water off Hollywood, Florida. In March 1989, polychaetes made up 51.7 percent of the macrofaunal community at that location followed by nematodes (14.3 percent), smaller species of crustaceans (9.0 percent), oligochaetes (4.3 percent), nemerteans (3.6 percent), and bivalves (2.9 percent).

Larger members of the invertebrate macrofauna seen occasionally in these offshore soft bottom areas between the second and third reef lines include the queen helmet, *Cassia madagascariensis*; the king helmet, *Cassia tuberosa*; Florida fighting conch, *Strombus alatus*; milk conch, *Strombus costatus*; Florida spiny jewel box, *Arcinella cornuta*; decussate bittersweet, *Glycymeris decussata*; calico clam, *Macrocallista maculata*; tellin, *Tellina* sp.; and cushion star, *Oreaster reticulatus*. Commercially valuable species, such as the Florida lobster, *Panulirus argus* move through this area as they migrate from offshore to nearshore areas (Courtenay *et al*., 1974).

Surf zone fish communities are typically dominated by relatively few species (Modde and Ross, 1981; Peters and Nelson, 1987). Fish species that can be found in the surf zone include, Atlantic threadfin herring, *Opisthonema oglinum*; blue runner, *Caranx crysos*; spotfin mojarra, *Eucinostomus argenteus*; southern stingray, *Dasyatis americana*; greater barracuda, *Sphyraena barracuda*; yellow jack, *Caranx bartholomaei*; and the ocean triggerfish, *Canthidermis sufflamen*, none of which are of local commercial value. Most of the fish making up the inshore surf community tend to be either small species or juveniles (Modde, 1980).

Fish species specifically associated with the sand flats and soft bottom areas between the first and second reefs off Palm Beach, Broward, and Dade counties include lizardfish, *Synodus* sp.; sand tilefish, *Malacanthus plumieri*; yellow goatfish, *Mulloidichthys martinicus*; spotted goatfish, *Pseudupeneus maculatus*; jawfish, *Opistognathus* sp.; stargazer, *Platygillellus (Gillellus) rubrocinctus*; flounder, *Bothus* sp.; and various species of gobies and blennies, none of which have significant local commercial value.

3.4.2 REEF/HARDGROUND communities

The classic reef distribution pattern described for southeast Florida reefs north of Key Biscayne consists of an inner reef in approximately 15 to 25 feet (5 to 8 meters) of water, a middle patch reef zone in about 30 to 50 foot (9 to 15 meters) of water, and an outer reef in approximately 60 to 100 foot (18 to 30 meters) of water. This general description was first published by Duane and Meisburger (1969) and has been the basis for most descriptions of hardground areas north of Government Cut, Miami since that time (Goldberg, 1973; Courtenay *et al*., 1974; Lighty *et al*., 1978; Jaap, 1984). Development of these three reef terraces into their present form is thought to be related to fluctuations in sea level stands associated with the Holocene sea level transgression that began about 10,000 years ago. An extensive sand zone lies between the middle and outer reef communities. It is in this sand area that the offshore borrow areas are located.

Lighty *et al*. (1978) showed that active barrier reef development took place as far north as the Fort Lauderdale area as late as 8,000 years ago. It is possible that the reefs and hardground areas seen from Delray Beach southward are the result of active coral reef growth in the relatively recent past, whereas the hard bottom features seen north of Palm Beach Inlet may represent the outcropping of older, weathered portions on the Anastasia Formation. The reefs north of Palm Beach Inlet (Lake Worth Inlet) do not show the same orientation to shore as those to the south and the classical "three reef" hardgrounds description begins to differ north of that inlet (Continental Shelf Associates, Inc., 1993a).

The composition of hardground biological assemblages along Florida's east coast has been detailed by Goldberg (1970, 1973), Marszalek and Taylor (1977), Raymond and Antonius (1977), Marszalek (1978), Continental Shelf Associates, Inc. (1984; 1985; 1987; 1993b), and Blair and Flynn (1989). Although there are a large variety of hard coral species growing on the reefs north of Government Cut, these corals are no longer actively producing the reef features seen there. The reef features seen north of Government Cut have been termed "gorgonid reefs" (Goldberg, 1970; Raymond and Antonius, 1977) because they support such an extensive and healthy assemblage of octocorals. Goldberg (1973) identified 39 species of octocorals from Palm Beach County waters. The U.S. Environmental Protection Agency (1992) lists 46 species of shallow water gorgonids as occurring along southeast Florida. Surveys by Continental Shelf Associates, Inc. (1984; 1985) identified 33 sponge, 21 octocoral, and 5 hard coral species on offshore reefs off Ocean Ridge and 40 sponge, 18 octocoral, and 14 hard coral species on the offshore reefs off Boca Raton. Blair and Flynn (1989) described the reefs and hard bottom communities off Dade County and compared them to the offshore reef communities from Broward and Palm Beach counties. They documented a decrease in the hard coral species density moving

northward from Dade County to Palm Beach County. Despite this gradual decrease in the density of hard coral species present, the overall hardground assemblage of hard corals, soft corals, and sponges seen along southeast Florida's offshore reefs remains remarkably consistent throughout the counties of Dade, Broward, and Palm Beach. Commercially, the most important invertebrate species directly associated with these hardground areas is the Florida lobster, *Panulirus argus*.

Common fish species identified with the reef/hardground communities include grunts (Haemulidae), angelfish (Pomacanthidae), butterflyfish (Chaetodontidae), damselfish (Pomacentridae), wrasses (Labridae), drum (Sciaenidae), sea basses (Serranidae) snapper (Lutjanidae) and parrotfish (Scaridae). Important commercial and sport fish such as black margate (*Ansiotremus surinamensis*), gag (*Mycteroperca microlepis*), red grouper (*Epinephelus morio*), red snapper (*Lutjanus campechanus*), gray snapper (*L. griseus*) Hogfish (*Lachnolaimus maximus*) and snook (*Centropomus undecimalis*) are also associated with these reefs. The precise composition of the fish assemblage associated with any given location along these hardground areas is dependent upon the structural complexity of the reef at that location.

Herrema (1974) reported over 300 fish species as occurring off southeast Florida. Approximately 20 percent of these species were designated as "secondary" reef fish. Secondary reef fish are fish species that, although occurring on or near reefs, are equally likely to occur over open sand bottoms. Many of these species, such as the sharks, jacks, mullet, bluefish, sailfish, and marlin (none of which have significant local commercial value), are pelagic or open water species and are transient through all areas of their range.

3.5 COASTAL BARRIER RESOURCES

There are no designated Coastal Barrier Resource Act Units located in the project area that would be affected by this project.

3.6 WATER QUALITY

Waters off the coast of Dade counties are classified as Class III waters by the State of Florida. Class III category waters are suitable for recreation and the propagation of fish and wildlife. Turbidity is the major limiting factor in coastal water quality in South Florida. Turbidity is measured in Nephelometric Turbidity Units (NTU), which quantitatively measure light-scattering characteristics of the water. However, this measurement does not address the characteristics of the suspended material that creates turbid conditions. According to Dompe and Haynes (1993), the two major sources of turbidity in coastal areas are very fine organic particulate matter and sediments and sand-sized sediments that become resuspended around the seabed from local waves and currents. Florida state guidelines set to minimize turbidity impacts from beach restoration activities confine turbidity values to under 29 NTU above ambient levels outside the turbidity mixing zone for Class III waters.

Ambient turbidity data for South Florida coastal waters are largely non-existent except for several areas around the inlets. However, turbidity values are generally lowest in the summer months and highest in the winter months, corresponding with winter storm events and the rainy season (Dompe and Haynes, 1993; Coastal Planning & Engineering [CPE], 1989). Moreover, higher turbidity levels can generally be expected around inlet areas, and especially in estuarine areas, where nutrient and entrained sediment levels are higher. Although some colloidal material will remain suspended in the water column upon disturbance, high turbidity episodes usually return to background conditions within several days to several weeks, depending on the duration of the perturbation (storm event or other) and on the amount of suspended fines.

3.7 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

The coastline within the project area is located adjacent to predominantly residential, commercial and recreational areas. The areas within the project are high energy littoral zones and the material used for nourishment are composed of particles with large grain sizes that do not normally have contaminants adsorbing to them. The nature of the work involved with the renourishment of beaches is such that contamination by hazardous and toxic wastes is very unlikely. No contamination due to hazardous and

toxic waste spills is known to be in the study area.

3.8 AIR QUALITY

Air quality within the project area is good due to the presence of either on or offshore breezes. Dade County is in attainment with the Florida State Air Quality Implementation Plan for all parameters except for the air pollutant ozone. The county is designated as a moderate non-attainment area for ozone.

3.9 NOISE

Ambient noise around the project area is typical to that experienced in recreational environments. Noise levels range from low to moderate based on the density of development and recreational usage. The major noise producing sources include breaking surf, beach and nearshore water activities, adjacent residential and commercial areas, and boat and vehicular traffic. These sources are expected to remain at their present noise levels.

3.10 AESTHETIC RESOURCES

The project area consists of light sandy beige beaches that contrast strikingly with the deep hues of the panoramic Atlantic Ocean. The eastern foreground consisting of dune vegetation is backdropped by condominium and hotel tropical landscape plantings in many areas. Coconut, sabal, and date palm trees provide vertical human scale transition between the structures and the beachfront. Beachfront plantings of sea oats, dune sunflower, seagrapes, morning glory vines and many other tropical beach plantings provide an aesthetic transition between the remaining dunes and the beach. The project segments consist of moderate to good aesthetic values with few exceptions throughout the entire project.

3.11 RECREATION RESOURCES

Dade County is a heavily populated county on Florida's Atlantic Coast, which receives a tremendous volume of tourists, particularly during the winter months. Those beaches that can be accessed by the general public are heavily used year round. Those beaches which are associated with condominiums, apartments and hotels have more restricted access for the general public, but receive use from the many visitors who frequent these facilities as well as those members of the general public who walk or jog along the beachfront.

The beach at Sunny Isles has public access and receives heavy use by swimmers and sunbathers. Adjacent to these beaches are many condominiums and hotels used by long term and short term visitors and residents of the area. Other water related activities within the project area include on-shore and offshore fishing, snorkeling, SCUBA diving, windsurfing and recreational boating. Most of the boating activity in the area originates from either Bakers Haulover Inlet or Government Cut. Both offshore fishing and diving utilize the natural and artificial reefs located within and adjacent to the project area. Commercial enterprises along the beach rent beach chairs, cushions, umbrellas, and jet skis. Food vendors can also be found along the beach areas. The revenue generated by beachgoers supports a resurgent Miami Beach business district in the project vicinity.

3.12 HISTORIC PROPERTIES

Documented transportation activities along the southeastern coast of Florida date from the second half of the 16th century. As a consequence of over 400 years of navigation in the Bahama Channel, several hundred shipwrecks have been documented in the waters off the southeast coast of the state. Remains of these and other unrecorded shipwrecks may be located in the vicinity of the proposed borrow areas.

Archival research and field investigations have been conducted for the study area and coordinated with the Florida State Historic Preservation Officer (SHPO). Results of the investigations for the SGC-2 and SGC extension are discussed in the reports, *A Submerged Cultural Resource Magnetometer Survey for Two Borrow Areas, Second Beach Renourishment, Dade County, Florida*, May 1993 and *A Magnetometer and Side Scan Survey, Borrow Area Extension, Dade County, Florida*, October 1996. Both reports were prepared by Tidewater Atlantic Research. Five magnetic anomalies were identified in

the areas surveyed during the field investigations described in the above referenced reports. One target was confirmed to be the remains of a modern steel hull vessel sunk as an artificial reef. The other four targets are considered to be potentially significant as their signatures correspond with those of previously identified National Register eligible submerged cultural resources. The report, *A Cultural Resources Magnetometer Survey for Breakwater Construction, Sunny Isles Vicinity, Dade County, Florida,* prepared by Mid-Atlantic Technology discusses the results of field investigations in the area of the proposed breakwater construction. One magnetic anomaly was found south of the study area. No significant historic properties have been identified on the beach segment proposed for renourishment.

4. ENVIRONMENTAL EFFECTS

This section is the scientific and analytic basis for the comparisons of the alternatives. See table 1 in section 2.0 Alternatives, for summary of impacts. The following includes anticipated changes to the existing environment including direct, indirect, and cumulative effects.

4.1 GENERAL ENVIRONMENTAL EFFECTS

The placement of sand on the beach and within the transition fill area would restore some of the beach's ability to provide protection against storms and flooding. It would also enhance the appearance and suitability for recreation along the beach and would provide additional habitat for threatened an endangered species of sea turtles. The construction of the breakwater would help reduce the increased erosion at the north end of Sunny Isles and help maintain the design beach profile to meet the project's 10 year renourishment interval. Dredging in the proposed borrow area would cause a depletion of sand, however the area does not currently support seagrass, reefs, hard bottom, or other particularly productive habitat that would be altered within the borrow area. Although hardgrounds are located outside of the borrow area, a buffer zone will be used to minimize or eliminate possible impacts due to dredging. Placement of the discharge pipeline across the first reef would impact the associated benthic community including soft and hard corals. Any adverse impacts to the first reef would be appropriately mitigated. If no action is taken, the project beach would continue to erode and shoreline recession would continue. This would require renourishing the north end of Sunny Isles (along with the associated environmental impacts) approximately every two years to maintain the project's design beach profile.

4.2 VEGETATION

4.2.1 PROPOSED ACTION: Beach renourishment, transition fill, and offshore breakwater construction

The proposed action consists of a combination of three of the alternative plans analyzed (beach renourishment, transition fill and a breakwater) and utilizes the borrow areas SGC-2 and SGC extension located south of Government Cut. Environmental impacts associated with the proposed action would be the same as those for each of the individual components (alternatives) making up the proposed plan. These impacts are addressed below.

4.2.2 Beach renourishment with advanced nourishment

There are no sea grasses algal communities present in the footprint of the beach fill or the adjacent nearshore areas. No work would be performed on vegetated upland or dune areas. No adverse impacts to either marine or terrestrial vegetation are expected.

4.2.3 groins

No vegetation exists on the beach where a groin would be constructed. No impacts to vegetation are expected.

4.2.4 offshore breakwaters

No vegetation exists in the area where a breakwater would be constructed. No impacts to vegetation are expected.

4.2.5 beach fill transition

This would be the same as for the beach nourishment alternative. No impacts to vegetation are expected.

4.2.6 Alternative sand sources

4.2.6.1 Borrow Areas South of Government Cut (Proposed Sand Source)

Depending on the season when dredging would occur, some ephemeral algal communities could be present in the borrow areas. Any algal communities present within the areas dredged would be affected. This impact would be short-term as the algal communities would be expected to regrow after dredging is completed.

4.2.6.2 Deep Water Sand Sources

No deep water offshore sources of sand have been identified or evaluated for this renourishment activity. Impacts associated with using deepwater sources cannot be predicted at this time. Information is not available concerning the suitability or environmental impacts associated with deep water dredging. It is unlikely that this information will be available for this proposed renourishment. It is possible that deep water sand sources may be identified at a later time for future nourishments of the Dade County Beach Erosion Control and Hurricane Protection Project. The assessment of impacts on vegetation would occur at that time.

4.2.6.3 Distant Domestic Sand Sources

No distant offshore sources of sand have been identified or evaluated for this renourishment activity. Impacts associated with using distant offshore sources cannot be predicted at this time. It is possible that distant offshore sand sources may be identified in the future. The assessment of impacts on vegetation would occur at that time.

4.2.6.4 Foreign Sand Sources

It is unknown at this time what effects dredging sand from a foreign source has, or may have in the future, on marine vegetation at or adjacent to the source of material. Further investigation would be needed to determine what effects may occur to the marine resources in the vicinity of the sand source. If a foreign source of sand were used, the borrow area would be designed with the proper precautions to ensure that seagrass and other marine vegetation would not be affected.

4.2.6.5 Upland Sand Source

Sand from an upland source would be obtained from a commercial quarry. There would likely be some terrestrial vegetation loss at the quarry site in association with the excavation of sand.

4.2.7 NO ACTION ALTERNATIVE (STATUS QUO)

This alternative would have no effect on marine vegetation. However, continued erosion could eventually result in the loss upland vegetation adjacent to the beach.

4.3 THREATENED AND ENDANGERED SPECIES

4.3.1 PROPOSED ACTION: Beach renourishment, transition fill, and offshore breakwater construction

Refer to the impacts addressed below for each individual component of the of the proposed action.

4.3.2 Beach renourishment with advanced nourishment

Beach nourishment and associated activities have the potential to impact sea turtles and may have the following effects. These potential effects would apply to any of the alternative sand sources discussed including the preferred borrow areas.

a. Scarp development leading to hindrance or blockage of accessibility to nesting habitat.

b. Adverse alteration of moisture levels or temperature in beach due to modified nesting material.

c. Compaction and cementation of beach sediments that cause reduced nesting success and aberrant nest cavity construction resulting in reduced nesting and/or hatching success.

d. If carried out during the nesting season, there is a potential for the destruction of nests that are not identified during the daily nest survey and relocation program.

e. Disruption of nesting activities that could lead to poor nest site selection and energetic cost diminishing egg production.

f. Disorientation or misorientation of hatchlings from adjacent beaches by artificial lights on dredge equipment or construction equipment on the beach.

Important physical characteristics of beaches include sand grain size, grain shape, silt-clay content, sand color, beach hardness, moisture content, mineral content, substrate water potential, and porosity/gas diffusion. By using proper management techniques such as nest relocation, tilling of compacted beaches, use of compatible sand, and smoothing of scarp formations, most of the negative effects can be avoided or corrected (Nelson and Dickerson, 1989a).

Artificial lighting along the beach is known to affect the orientation of hatchlings (Dickerson and Nelson, 1989; Witherington, 1991) and to effect the emergence of nesting females onto the beach (Witherington, 1992). If beach nourishment occurs during the sea turtle nesting season, lighting associated with construction activities on the beach may effect hatchlings and nesting females. Research has shown that low pressure sodium (LPS) lights that emit only yellow wavelengths do not attract hatchlings (Dickerson and Nelson 1988 and 1989; Nelson and Dickerson, 1989b). Witherington (1992) demonstrated that LPS lights on the beach did not significantly effect the nesting behavior of green or loggerhead sea turtles. The use of LPS lighting at the beach nourishment site and on the dredge can reduce the potential for lighting effects on sea turtles. However, the Corps is concerned about the appropriateness of using LPS lights in a marine environment for safety reasons. In a letter dated January 29, 1998, the USFWS revised their requirement for using LPS lights to a recommendation.

4.3.3 groins

If constructed during the sea turtle nesting season, construction activities and lighting would have similar affects on hatching orientation and nesting female behavior as discussed for the beach nourishment alternative. If constructed outside the nesting season there would be no adverse affects due to construction activities. Improperly designed and/or placed groins could potentially interfere with sea turtle nesting and hatchling emergence and egress offshore.

4.3.4 offshore breakwaters

This activity would occur near Golden Beach. While sea turtle nesting density is not particularly high on Golden Beach, the nests are not normally relocated to a safe hatchery. If construction occurs during the turtle nesting season, construction activities and lighting would have similar affects on hatching orientation and nesting female behavior as discussed for the beach nourishment alternative. If constructed outside the nesting season there would be no adverse affects. The breakwater would be designed to have at least 3 to 4 feet of water over the top at low tide. It is also designed to be in two segments (each 375 feet long) with a 250 foot gap in between. Because the breakwater will be

segmented and submerged it is not expected to interfere with the movement of female sea turtles to the shore to nest, or with the egress of hatchlings heading offshore.

4.3.5 beach fill transition

This activity would occur off Golden Beach. While sea turtle nesting density is not particularly high on Golden Beach, the nests are not normally relocated to a safe hatchery. The potential impacts discussed for the beach nourishment alternative would also apply to the construction of a beach fill transition.

4.3.6 Alternative sand sources

4.3.6.1 Borrow Areas South of Government Cut (Proposed Sand Source).

Hopper dredging in harbors and entrance channels is known to adversely effect sea turtles by entrainment. These incidents occur because sea turtles utilize and are concentrated in these channels during certain times of the year. Sea turtles utilize hardground and reef areas for foraging and resting and may be present on the hardground areas adjacent to the proposed borrow areas during dredging. It is not expected that sea turtles will concentrate in the sandy borrow area as they do in navigation channels; therefore it is unlikely that the dredge draghead will come into direct contact with a sea turtle. Since the boundary of the borrow area is designed to avoid hardgrounds, it is not expected that the hopper dredge will have a direct impact on any sea turtles utilizing the hardgrounds for resting or foraging. To further ensure that sea turtles are not entrained by the dredge, the use of a draghead designed to deflect sea turtles would be required on the dredge. The deflector draghead is designed to form a sand wedge in front of it that will push out of the way any sea turtle that it comes in contact with. The deflector draghead has been successfully used in the maintenance dredging of navigation channels along the Southeastern United States. During past beach nourishment projects there has been no evidence of sea turtles being entrained by a hopper dredge dredging sand material from an offshore borrow area. The material within the proposed borrow areas that will be dredged and placed on the beach is similar to the existing beach sand, is low in silt content and therefore, would be compatible with sea turtle nesting.

4.3.6.2 Distant Domestic or Deep Water Sand Sources

Depending upon the location and the type and quality of material, use of sand from these sources may have biological impacts similar to or greater than use of the proposed borrow areas.

4.3.6.3 Foreign Sand Sources

Carbonate sand from the Bahamas or the Turks and Caicos tend to have a lighter color than native sand. Because of this lighter color, the temperature of the sand is cooler. Lutz et al. (1991), at Fisher Island, Florida, documented that temperature averaged 2°C cooler in nests relocated into a Bahamian carbonate sand (aragonite) nursery than nests relocated into natural South Florida beach sand. This 2°C decrease could lower the nest temperature below the pivotal temperature for sex determination in sea turtles and skew sex ratios, possibly causing an increase in male sea turtles. The lighter color of the Bahamian sand was considered a possible factor in causing the cooler temperature. The Fisher Island study used a processed sand (washed twice and sifted) and this sand is probably cleaner and lighter in color than sand dredged directly off the Bahamian Bank. The darker non-processed sand could be warmer and may not modify the temperature as much relative to native material. Currently, the Corps, DERM, Florida Atlantic University, the University of Florida and a number of agencies are evaluating the effects of various types of sand, including foreign carbonate sand, on sea turtles. Results from the first year of the study did not show significant differences in the overall sex ratios between the different sand types used (Nelson, et. al. 1996). However, that study was a first year study and a larger sample size and modified sampling regime may be appropriate for future studies. Sea turtle nesting naturally occurs on Bahamian sand beaches in the Caribbean in low numbers, however, very little of the Caribbean has been surveyed and nesting density may actually be higher (Carr et al.1982). While sea turtles do successfully nest in Bahamian sands, it is possible that the rate of success (portion of nests to total crawls) would be different from that in native Florida sand.

4.3.6.4 Upland Sand Source

The material obtained from an upland source would be predominantly quartz which would replace a predominantly calcium carbonate beach. It is not expected that the quartz sand itself would significantly effect nesting sea turtles or hatching success since the majority of the high density nesting beaches in Florida are comprised of predominantly quartz sand (i.e., Brevard County). However, some of the other negative impacts previously discussed (sand compaction, potential for scarp formation, artificial lighting effects, etc.) would still apply.

4.3.7 NO ACTION ALTERNATIVE (STATUS QUO)

If no action is taken, the beach would continue to erode. If left to erode, this could ultimately result in the loss of sea turtle nesting habitat and/or poor nest site selection. If more frequent "interim" renourishments are required to maintain the beach at the project design, then there would be an increase in the potential effects to sea turtles from construction activities. No adverse impacts are expected on other listed species.

4.4 FISH AND WILDLIFE RESOURCES

4.4.1 PROPOSED ACTION: Beach renourishment, transition fill, and offshore breakwater construction

Refer to impacts discussed below for each individual component of the proposed action.

4.4.2 Beach renourishment with advanced nourishment

During the placement of sand on the beach there may be some interruption of foraging and resting activities for shorebirds that utilize the project area. This impact would be short-term and limited to the immediate area of disposal and time of construction. There would be sufficient beach area north and south of the renourishment sites that can be used by displaced birds while construction takes place. Increased foraging opportunities for some species, such as sea gulls, can also occur as a result of the discharge activity. Elevated turbidity levels within the immediate vicinity of the discharge site may interfere with foraging by sight feeders such as the brown pelican (*Pelecanus occidentalis*). However, increased turbidity levels would be limited to a small portion of the shoreline and should not result in significant impacts to foraging activities.

The disposal of sand on the beach would have temporary impacts to the macroinfaunal community. Some organisms may be buried and lost, but many organisms inhabiting the intertidal zone are well adapted for burrowing and would be able to burrow up through the fill material and survive. Turbidity levels along the disposal site would temporarily increase, but would return to normal after beach equilibrium is achieved. Organisms inhabiting this zone would be impacted by the run off from the disposal area but are adapted for survival in such conditions and impacts should be minor. Dominant infaunal inhabitants of the intertidal zone, such as amphipods, isopods and polychaetes typically possess high fecundity and rapid turnover rates during their breeding season. Because of this, any losses due to construction activities would be replaced within a short time. No long-term adverse effects are anticipated to the intertidal macroinfaunal community due to nourishment activities (Deis, et al. 1992, Nelson 1985, Gorzelany & Nelson 1987, USFWS 1997).

Minimal impacts to nearshore hardbottom communities are expected by sand placement (i.e., disposal) on the beach due to the distance of the reefs to the shore. In conjunction with the Coast of Florida Erosion and Storm Effects Study, the hardground areas offshore of Dade County were mapped using side scan sonar. The closest hardground community in the Sunny Isles and Golden Beach vicinity is 750 t0 800 feet offshore.

The communities found offshore of Sunny Isles out to one-half mile from shore are described in Dodge et al. (1987). Dodge characterizes four community types within this area. (1) non-vegetated sand flats occurring; (2) soft coral communities in sand deposits of 3" to 6" or greater depth; (3) soft coral and attached algae on sand bottom; (4) hard coral community hardground "reefs". Of these community types, only the last one is characteristic of hardbottom reef areas (i.e., continuous rocky substrate with

epibiotic growth). The other community types noted by Dodge et al. (1987) have developed and grown in these highly dynamic areas of sand movement, characterized by sporadic, episodic sand inundation and removal. The organisms that colonize these areas are more tolerant of the dynamic conditions that exist in these areas, and comprise a stable community adapted to sand movement of the nearshore system. The community types (2) and (3) above correlate to the hardbottom areas located closest to shore as interpreted by side scan sonar. The hardground areas ((4) above) noted by Dodge et al. (1987) were reported as being "never closer than 1500 feet and generally greater than 1800 feet from shore", and that "the hard coral coverage and diversity is greatest on the seaward portions of the transects" (greater than 3000 feet from shore). Because the communities nearest the shore (within 1500 feet) are adapted for periodic sand movement within the zone it is not expected that these communities will be effected by the placement of sand on the beach or the subsequent periodic offshore-onshore movement of that sand. The shoreward edge of the hard coral community described above is at least 1000 seaward of the anticipated equilibrium toe of the beach fill and would not be directly impacted by the sand.

Due to the depth requirements for the dredge, it must remain seaward of the first reef tract to pump material to the beach. It is therefore necessary to place a discharge pipeline across the reef from an offshore pump-out platform to the beach fill site. Alternative methods for pipeline placement were considered such as a floating pipeline and supporting the pipeline above the bottom on "braces". However, these methods were determined not to be feasible or not acceptable. Due to the length of the pipeline that would need to be floated (approximately 1 mile), the orientation of the pipeline to normal traffic patterns and currents (i.e., perpendicular to the flow), the duration of the project and the extensive commercial and boating traffic off Dade County, the floating pipeline would pose an unacceptable hazard to navigation and increase the probability of pipeline failure through flex stressing or vessel collision. Consideration was also given to elevating the pipeline on supports. However, due to the number, size and spacing of the supports needed to suspend and stabilize the pipeline off the bottom, the cumulative impact from placing the supports would be greater than the anticipated impact if the pipeline were placed on the reef. If pipeline supports were used, the equipment necessary for installing the supports and placing the pipeline on the supports would be working directly on top of the reef areas. Work barges would need to be spudded or anchored onto the sea floor to install the supports and to place the pipeline. This would cause extensive damage to the reef.

In association with the 2nd periodic renourishment at Sunny Isles and Miami Beach, DERM conducted a survey of the reef areas offshore of the beach fill segments to assess habitat complexity and determine a path that would minimize impact to benthic organisms and "high quality" habitat. The habitat quality was assigned in consideration of many factors including: density and diversity of the organism groups assessed, relief of habitat, width of hardground supporting specific community types, and amount of sand coverage. The survey methodology and results are attached as Appendix E of this EIS. The survey identified two 50 ft. wide corridors, one off Sunny Isles and one off Miami Beach, where minimal impact would occur from placement of the pipeline. These pipeline corridors were used for the Sunny Isles/Miami Beach renourishment that was completed in July 1997.

Prior to project construction, DERM estimated that the area of impact from the pipeline would be 808.8 m^2 to 1,213.0 m^2 at Sunny Isles and 890.57 m^2 to 1,324.61 m^2 at Miami Beach. The estimated area of impact was based on the bottom communities within the pipeline corridors and the anticipated length and width of the impact tract resulting from pipeline placement on the hardbottom. Anticipated impacts included: physical crushing, abrasion and shading of benthos (algae, sponges, soft coral and hard coral). It was expected that the major impact would occur to sponges, algae and soft corals, with some loss to hard corals.

The actual level and extent of impact within the corridors was determined through post-construction surveys performed by DERM biologists. After construction was halted in September 1994 by the Federal Court, DERM assessed the impacts from the pipeline on the reef within the Miami Beach corridor. The post-placement inspection of the pipe found it to be in contact with the reef only sporadically. Irregularities of the reef and the connector collars (or rings) used to connect the pipe segments, held the pipeline off the reef surface for considerable distances. In general, impacts to the bottom were much less than expected. The most severe impacts noted were to large hard coral heads having a colony

diameter up to 2.0 m. The most common impact was to erect, dendroid soft corals that bordered the pipeline. These corals were abraded by the constant wave surge moving their branches against the pipeline. The total impact due to the pipeline was determined to be 207.1 m^2.

Upon completion of the 1997 Sunny Isles/Miami Beach renourishment, both pipeline locations were assessed by DERM between July 24, 1997 and August 28, 1997. The results of the assessment were consistent with the 1994 Miami Beach assessment. That is, the pipeline was not in continuous contact with the reef, but held off by irregularities in the reef and by the large connector rings used to connect pipe segments. The most common benthic impact found was bleaching of hard corals which had been shaded by the pipeline. Places where the pipeline had touched the bottom were evidenced by crushed and fractured hard corals and compacted or scarified limerock hardground. Fractured corals were removed from the pipeline corridor and repaired, if possible, using quick setting concrete and Liquid Roc ^{TM} epoxy adhesive. As a result of the hard coral restoration, 63.7% of the impacted hard corals was salvaged and stabilized onto the reef (63.7% of the impacted coral was alive after the salvage/restoration procedure). As found in the 1994 assessment, impacts to soft corals were most commonly in the form of abraded branches. The basal holdfasts of the soft corals were, in all but a few cases, undamaged. A total benthic impact of 39.5 m^2 was calculated for the Miami Beach pipeline segment, and 66.77 m^2 was calculated for the Sunny Isles corridor. The lessor impact along the Miami Beach corridor is believed to be attributable to the prior use of the corridor. The 1997 placement of the Miami Beach pipeline was within <3 m of the previous (1994) placement. Therefore, benthic (hardcoral) impacts to the Miami Beach section of the first reef for the second phase of construction were much less than those documented in 1994. The methodology used for the post construction assessments and the results of the surveys are presented in Appendix F.

The pre-project impact assessment estimated 808.8 and 1,213 m^2 the Sunny Isles pipeline based on a 0.6 to 1.0 m wide impact path along the entire length of the pipeline on the reef. However, the impact was considerably less than estimated. This was the result of several factors. The pre-project evaluation of the reef area over which the pipeline was to be placed provided a 'minimal impact" path for the corridor. In addition, the connector rings for the pipeline segments raised substantial lengths of the pipe off the bottom (between 50 and 100 feet, dependent on localized relief). Finally, the irregularities of the reef itself served as point supports for the pipe, allowing substantial lengths of the pipeline (up to 150 to 200 feet) to remain off the bottom. Although organisms in contact with the pipe (soft corals, sponges and hard corals) were impacted, many of these were saved by the "suspended" pipeline.

Both the Sunny Isles and Miami Beach corridors have been permanently marked underwater with concrete blocks cemented to the substrate. The location of these cement markers have been recorded using differential GPS. Surface or subsurface buoys can be attached to the blocks, which would allow a contractor to place a pipeline along or very near the previous impact path. This would greatly reduce future impacts to the reef because many hard corals in the impact path have already been relocated and repaired. The Sunny Isles corridor would be used for the proposed action.

Any impacts to the first reef from placing the pipeline will be appropriately mitigated. The mitigation would be similar to what was performed for the 1997 Sunny Isles and Miami Beach renourishment. The preferred mitigation program would provide for "in-kind" mitigation. For the proposed project this would mean providing relatively low relief shallow water habitat composed of limerock or carbonate based reef materials and placed as close to the impacted area as possible. Currently there are two reef components in use that would satisfy the preferred material conditions. One is limerock boulders and the other is prefabricated modules composed of pre-cast concrete culvert, with limerock grouted to the exterior surface. The prefabricated modules were used for the Sunny Isles and Miami Beach mitigation. A mitigation plan specific to this project will be developed in coordination with FDEP, DERM, and the Corps.

4.4.3 groins

Construction of a groin or groins would have temporary impacts on the macroinfaunal community on the beach within the construction area. These impacts would be similar to those described for beach

renourishment, but on a much smaller scale. It is not expected that groin construction would have any effect on any hardbottom communities.

4.4.4 offshore breakwaters

Construction of a breakwater would have a minor and temporary impact on the macroinfaunal community within the construction area during construction activities. Once constructed the area within the breakwater footprint would not be available for recolonization by benthic organisms. During construction, turbidity and sedimentation levels would be elevated within the immediate vicinity of construction. These would be temporary and would return to normal once construction is completed. Increased turbidity and sedimentation may have some impact on the nearshore hardbottom community immediately adjacent to the construction site. Precautions such as using of turbidity curtains would be implemented to minimize any impacts.

4.4.5beach fill transition

The potential impacts discussed for the beach nourishment alternative would also apply to the construction of a beach fill transition.

4.4.6 Alternative sand sources

4.4.6.1 Borrow Areas South of Government Cut (Proposed Sand Source).

Organisms similar to the beach macroinfaunal community can be found in the borrow area. Dredging would result in the loss of these organisms; however, recolonization is expected to be fairly rapid. In a study of a borrow area located offshore of Delray Beach, Florida, Bowen and Marsh (1988) concluded that recovery of the infaunal community occurred within 1 year. Cutler and Mahadevan (1982) found no significant differences in biotic communities between borrow sites and surrounding areas off Panama City, Florida, some 3-4 years after a beach nourishment project. No long-term adverse impacts are expected to macroinfaunal communities that inhabit the proposed borrow site.

The offshore borrow area is located between the second and third reef hardbottom communities. Sessile organisms associated with the hardbottom community may be susceptible to some degree of negative impact due to dredging. Potential adverse impacts to the these communities may occur due to suspended sediments settling onto the reef, mechanical damage from contact by the dredge drag arm with the reef, or turbidity. As a group, scleractinian corals are the most sensitive to potential impacts. Gorgonian corals, sponges, and some other sessile organisms are more tolerant of increased turbidity and sedimentation. Past occurrences of mechanical and/or sedimentation damage to reef communities have been documented for the renourishments at Sunny Isles in 1988 and at Bal Harbour in 1990. Mechanical damages in 1988 and 1990 to reefs were from contact with the dredge drag-arm. In the 1988 incident, the dredge damaged hardbottom outside the designated dredging area. In the 1990 incident the dredge caused damage to previously undiscovered hardbottom within the designated dredging area. Sediment impacts to the reef during the 1990 incident was caused by the dredge spending a significant amount of time dredging a in one confined area between reefs located immediately north and south of the area dredged. Blair and Flynn (1988) and Blair et al. (1990) discuss factors believed to have contributed to the impacts documented, and recommended modifications to project specifications to reduce or eliminate the impacts. The area affected in 1990 included 85.3 m^2 of direct mechanical impact, 114.8 m^2 sediment impact to hard coral, and 55,604.0 m^2 sediment impact to other benthic organisms (area with ^{3} 4 cm sedimentation). Special considerations have been incorporated into the proposed Sunny Isles project to avoid or minimize the potential for impacts to the hardbottom community.

A buffer zone with a minimum distance of 400 ft from any hardground area has been established for the proposed borrow areas. Extensive turbidity monitoring will be performed at the beach fill and dredging sites, throughout the construction phase of the project to ensure levels of turbidity are maintained below the State water quality standard. Visual inspections of the hardbottoms adjacent to the borrow area would be performed. The regions of hardbottom in proximity to the dredging area would be surveyed at

least twice a week to look for any indicators of turbidity or sediment impacts. Marine biologists with experience in impact assessment would conduct the surveys and examine the benthic organisms for pre-defined indicators of stress or imminent impact. Findings of such indicators would cause actions ranging from consultation to halting of the dredge operations until a determination can be made as to the cause and rectification of the factors creating the stress or imminent impact. The established buffer zones, borrow area usage restrictions and visual inspections of the reef will minimize or eliminate turbidity and sedimentation impacts.

Proper controls and procedures would be utilized to avoid the mechanical damage that could result from the dredge or associated equipment coming in contact with the hardbottom. Project and construction specifications that would prevent such damage are: (a) Recording and displaying, real-time precision electronic location equipment must be in use during dredging operations. This equipment would provide the precision equivalent to that of a differential GPS system, provide records of the exact position of the dredge to the operator and allow continuous monitoring of the dredge location during operations. Daily reports would include a plot indicating the dredge location while operating in or within a quarter of a mile of the borrow area, keyed to a printout listing coordinates at specified time intervals. (b) Pipelines would be placed only in approved locations and anchoring would be permitted in sandy areas only. (c) The borrow area perimeter will be marked by placement of Coast Guard approved lighted buoys. The buoys will be placed at an interval no greater than 400 ft apart, at every change of direction of the borrow area, and no closer than 400 feet from any hardground area. The distance of all borrow area buoys from the hardgrounds will be verified by divers and their positions recorded. (d) The edge of the hardbottoms adjacent to the borrow area will be marked by buoys at a sufficient frequency to visually discern the line of hardground edge. All buoys (borrow area and hardground) will be checked regularly, and replaced or repositioned as necessary, throughout the period of construction. (e) The Corps and Dade County DERM have developed a procedure that would allow suspension or alteration of the dredging operation if monitoring by DERM indicates a problem.

Additional measures to protect the reefs in the vicinity of the borrow area would include an intensive reef monitoring program. This is similar to what was performed during the 1997 renourishment at Sunny Isles and Miami Beach and what is proposed for the upcoming renourishment at Surfside and South Miami Beach. The program would monitor and evaluate numerous biological and physical characteristics and indicators for signs of stress or impact related to construction activities. This comprehensive program is designed to identify factors that may contribute to or cause stress and minor impacts, before they cause non-reversible impacts. Among the parameters assessed in the monitoring program are: benthic community structure, including hard coral, sponge and algal populations; fish populations of the hardbottom areas; infaunal assemblages of the beach area and borrow area; water quality, including nutrients, light penetration, turbidity and physical characteristics. These factors will be surveyed prior to and after project construction, and will be monitored regularly during project construction. For reference, a copy of the Comprehensive Monitoring Plan for the renourishment at Surfside and South Miami Beach is included as Appendix G of the EIS.

Rock, shell and coral rubble material that is dredged up with the sand, but unsuitable for placement on the beach (i.e., >1 in. diam.), would be placed in a permitted artificial reef site. The habitat in the area where the rock is deposited, would change from what is now a predominantly sand benthic macroinfaunal community to a hardbottom benthic community. The rock would provide a concentrated hard substrate suitable for colonization by sessile benthic organisms. This would allow for the development of coral, plant, invertebrate and vertebrate communities and would provide a viable habitat with refuge, food resources, and a potential breeding ground for a wide variety of marine organisms. This would be the best use of this material, as the rock separated from the sand would be, and have been, devoid of external epibiotic growth (algae, sponges, coral, encrusting organisms) at the time of removal. The rock material that would be disposed in the artificial reef site is clean natural material.

Fish are a highly motile group of organisms. During dredging most fish species will avoid the dredge area and quickly return upon dredging completion. No long-term impacts are expected to fish communities inhabiting the borrow area. The rock disposal area should provide a substrate that will act as an artificial reef and be beneficial to fish. Many gamefish species, both juveniles and adults, are associated with these areas. Hardgrounds generally display increased productivity compared to sand

bottoms.

4.4.6.2 Deep Water, Distant Domestic, Foreign, and Upland Sand Sources

The use of any of these sand sources would not have any of the adverse affects on the local hardground communities that would be associated with the dredging of an offshore borrow area. However, using other offshore sources would involve dredging at the location of the source of sand. The impacts of dredging at alternate sites cannot be predicted, not knowing location of the area(s) that would be dredged or the types of habitats present. It is expected that any hardground that might be present would be avoided to the extent practicable and that unavoidable impacts would be mitigated. Using an alternate offshore source would require pumping the material to the beach from the transport vessel. This would also be required if upland sand were barged to the project area and trucks were not used to haul the material to the beach. Both these options would have the same impacts to the nearshore reef community as the preferred borrow areas (SGC-2 & SGC extension). These impacts are discussed in section 4.4.6.1.

4.4.7 NO ACTION ALTERNATIVE (STATUS QUO)

With the no action alternative, more frequent "interim" renourishments would be required to maintain the north end of Sunny Isles at the authorized project dimensions. It is estimated that the "interim" renourishments would be needed about every 2 years. The potential impacts associated with beach renourishment discussed previously would be increased compared to the proposed action, which would have a 10-year renourishment interval.

4.5 COASTAL BARRIER RESOURCES

The purpose of the Coastal Barrier Resources Act is to minimize the loss of human life, wasteful expenditure of Federal moneys; and the damage to fish, wildlife, and other resources associated with the coastal barriers along the Atlantic coast by restricting future Federal expenditures and financial assistance, which have the effect of encouraging development of these coastal barriers. There are no designated Coastal Barrier Resource Act Units located within or adjacent to the project area.

4.6 WATER QUALITY

The proposed action would cause temporary increases in turbidity at borrow area and beach disposal sites. The rock material to be placed at the artificial reef site will be clean and free of any significant amount of fines or silty material. However, there may be some slight elevation of turbidity in the immediate area of disposal. There may also be some disturbance of the bottom sediments as the rock hits the ocean bottom, causing some minimal turbidity. The State of Florida water quality regulations require that water quality standards not be violated during dredging operations. The standards state that turbidity outside the mixing zone shall not exceed 29 NTU's above background. Results from turbidity monitoring at previous beach nourishment projects have shown that the turbidity did not exceed the standard. Various protective measures and monitoring programs would be conducted during construction to ensure compliance with state water quality criteria. Should turbidity exceed State water quality standards as determined by monitoring, the contractor would be required to cease work until conditions returned to normal. The proposed action has been evaluated in accordance with Section 404 of the Clean Water Act and a 404(b) evaluation report has been included as Appendix A to this EIS. The use of other submerged borrow sites would have similar turbidity impacts on water quality as using the proposed borrow areas. Use of upland sources would not have the impacts associated with dredging an offshore borrow area, but would the same impact along the beach fill area.

4.7 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

There are no hazardous, toxic, or radioactive waste sites or producers in the project area that would be affected as a result of the preferred alternative. No impacts associated with the disturbance of such sites are anticipated from either the recommended or no-action alternatives. However, use of previously

uninvestigated borrow sources would require examination for potential problems with harmful substances. This would involve examination of recorded spills and a "Preliminary

Assessment Screen". If these indicate a potential for contamination, we would either try to avoid the potential contamination, look for another site, or consider remediation.

With the use of dredging and construction equipment in the in the areas around the borrow and beach fill sites, there is the potential for hydrocarbon spills or other effluent releases. However, the likelihood of significant accidents and releases of this sort is very remote. The contract specifications will require the contractor to develop accident and spill prevention plans. The no-action alternative should not allow conditions to develop that would increase accidents or releases of this sort.

4.8 AIR QUALITY

Direct emissions from the proposed action would be confined to exhaust emissions of labor transport equipment (land and water vehicles), and construction equipment (dredge barges). These emissions would likely be well under the *de minimus* levels for ozone non-attainment areas as cited in 40 CFR 91.853; that is, projects implemented cannot produce total emissions greater or equal to 100 tons per year of Volatile Organic Compounds (VOCs). Any indirect increase in emissions (indirect emissions), as a result of the proposed action is beyond the control and maintenance of the USACE. Consequently, a conformity determination with the Florida State Implementation Plan is inappropriate for increases of indirect emissions from the proposed action. As with the proposed action and alternatives, the no-action alternative will see continued development, which may cause marginal adverse impacts to air quality. The extent of these impacts, however, is difficult to predict.

4.9 NOISE

With the implementation of the proposed action there would be a temporary increase in the noise level during construction. The principle noise would stem from the vicinity of the discharge point on the beach, the breakwater construction site and the dredge. Construction equipment would be properly maintained to minimize the effects of noise. Increases from the current noise levels as a result of the proposed action would be localized and minor, and limited to the time of construction. There would be no noise related impacts associated with the no-action alternative.

4.10 aesthetics

There would be a temporary increase in the noise level during construction. The principle noise would stem from the vicinity of the discharge point on the beach and the dredge. Construction equipment would be properly maintained to minimize the effects of noise. Increases to the current levels of noise as a result of this project would be localized and minor, and limited to the time of construction. Engine exhaust fumes would be rapidly carried away by breezes. Any temporary decrease in air quality caused by this work would be corrected once work is completed. Hundreds of feet of dredge pipe lying on the beach or just offshore would have a negative visual impact on the aesthetics of the area. This impact would only be temporary and would be removed along with the pipe at the completion of the work. The negative visual impacts of the equipment and pipe would be offset to an extent by the natural curiosity of some individuals to see what is going on and how work is progressing. There would also be a temporary increase in turbidity during construction adjacent to the point of discharge. Turbidity would return to normal levels once construction activities cease. Once completed the proposed project would result in an overall improved aesthetic quality. The placement of sand on the beach would restore the natural appearance of the shore. With the no-action alternative, the shoreline would continue to erode. This would result in the loss of existing shoreline, which would reduce the visual aesthetics of the area.

4.11 recreation

During nourishment activities, the use of the beach in the vicinity of construction would drop or be restricted temporarily. Use of the beach in the immediate area of the discharge pipe and equipment would be restricted for public safety. Noise from the heavy equipment needed to spread and smooth the sand would disturb some users as well. Many visitors would seek quieter areas for sunbathing or

swimming. As portions of the renourished beaches come available, use by the general public would increase once more. After nourishment of the beach, use by the general public and those who stay at the condominiums and hotels would return to pre-erosion activity levels. The general public would be more inclined to use these beaches rather than by-passing them for others with more sand above the high tide line. It has been suggested that the proposed breakwater would attract surfers. It is possible that waves would "break" over the breakwaters and provide a better surfing environment (see also section 4.13 on Health and Safety). There would be a temporary adverse effect on recreational fishing in the immediate area of beach fill operations and at the borrow area due to construction activities and turbidity. Fishing would not be affected outside the area of immediate construction. Nearshore snorkeling, and SCUBA diving activities may also be impacted by increased turbidity during construction activities and shortly thereafter. Long-term adverse impacts to these water activities are not anticipated. Boat operations may be detoured during construction activities; however, the extent of these detours and time frame of operations render these impacts insignificant. With the no-action alternative, the shoreline would continue to erode. This would eventually reduce the amount of beach available for recreation and would result in the degradation or loss of shorefront property thus, adversely impacting beach recreational opportunities within the area. There would be no construction related impacts to fishing, snorkeling and SCUBA diving with the no-action plan.

4.12 historic properties

As stated previously, archival research and field investigations were conducted for the Borrow areas and the breakwater location proposed for this project. Four potentially significant magnetic anomalies were identified in the vicinity of the SGC-2 and SGC extension borrow areas. Another potentially significant anomaly was identified south of the proposed breakwater location. Reports describing these investigations and the identified resources were coordinated with the SHPO. In consultation with the SHPO it was determined that 200 to 250 foot radius buffer zones would protect the anomalies located in the vicinity of the borrow areas. The anomaly south of the breakwater location is outside the area of effect. In letters dated June 17, 1993 and May 29, 1996, the SHPO concurred with the Jacksonville District's no effect determination for the anomalies in the vicinity of the borrow areas. In a letter dated November 30, 1994, the SHPO concurred with the District's no effect determination for the construction of the breakwater. In a May 19 1993 letter, the SHPO concurred with the District's no effect determination placement of sand on the beach.

4.13 ENERGY REQUIREMENTS AND CONSERVATION

The energy requirements for this construction activity would be confined to fuel for the dredge, labor transportation, and other construction equipment. The expenditure of energy would be much less using the proposed borrow areas than obtaining material from other sources described in the alternatives section. For example, the use of sand from the Bahamas or other distant sources would require the use of more energy to transport the sand for beach fill. The use of upland sand would most likely require the expenditure of additional energy to perform repairs to local roads and highways damaged by trucks hauling material to the beach. The no-action alternative would allow conditions to develop that may endanger coastal property from storm surges and wave erosion during future storm events. On-site preventive measures and post clean up under the no-action alternative would likely demand greater energy than that required of the proposed action. In addition, the no-action alternative would also require more frequent renourishment intervals (2 year cycle) at the north end of Sunny Isles to maintain the project design profile, which is the current condition. This would increase the energy usage over the proposed plan.

4.14 health and safety

It has been suggested that the breakwater would present a safety hazard to swimmers, boaters, and surfers (see also section 4.11 on Recreation). The breakwater would in many respects mimic a natural offshore berm. It would be a "soft" structure and variously covered or encroached upon by sand drifts. It would alter wave and nearshore current patterns to some degree. We would install appropriate signage as required by the U.S. Coast Guard and other authorities as applicable.

4.15 private property rights

At the public scoping meeting, residents of Golden Beach expressed a concern of the impact of an accreting beach on property rights. In particular, whether the accreted beach would become a public beach. We are investigating this issue. At the present time, we do not know the private property implications. We do not plan to place any material for the transition fill off Golden Beach on any private property. The transition fill would be placed on state owned water bottoms only. However, as is the nature of coastal processes, the shoreline is constantly changing. Currently, Golden Beach has an accreting shoreline. The proposed action would likely increase the accretional forces at Golden Beach. While this property issue is a matter to be decided by the state, we plan to obtain all real estate instruments required to perform the work.

4.16 NATURAL OR DEPLETABLE RESOURCES

In this case, the beach quality sand used to construct the project is the depletable resource. Using sand from the proposed borrow area will deplete the sand source from the areas dredged at that site. Eventually the sand will be redistributed over nearshore areas. It is unlikely that the redistributed sand will return to where it was removed, resulting in a depletion of resources in the borrow areas. The gasoline and diesel fuel used by the dredge and other construction equipment is also a depletable resource.

4.17 CUMULATIVE IMPACTS

Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). The use of sand from the proposed borrow area will deplete the area of sand and species of relatively non-motile infaunal invertebrates (mollusks). However, many of those species that are not able to escape the construction area are expected to recolonize after project completion. Repeated placement of pipeline for periodic nourishment would have a cumulative impact on nearshore hardground habitat. However, using the same corridors for each renourishment to the extent practicable would minimize such cumulative impact. The proposed action would result in long-term benefits, which should outweigh any short-term environmental losses. The cumulative impact of shore protection projects along the Florida coast has been to restore and maintain many beaches which otherwise would have experienced severe erosion or would have totally disappeared. In addition, these activities have reduced property damage and helped maintain property value.

4.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

4.18.1 IRREVERSIBLE

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. One example of an irreversible commitment might be the mining of a mineral resource. The use of sand from the proposed borrow area would (for all practical purposes) irreversibly deplete the suitable sand reserves. The sands would not replenish fast enough to be of much value to future nourishment and renourishment projects. There will however, be sufficient sand remaining in the dredged area for recolonization of benthic organisms. Any impacts to larger hard coral could be irreversible for practical purposes given the long amount of time needed to regrow older and larger specimens. Measures would be taken to try to avoid such impacts and the mitigation plan calls for efforts to move, reattach, or otherwise salvage as much hard coral that might be damaged as possible. The energy and fuel used during construction would also be an irreversible commitment of resources.

4.18.2 IRRETRIEVABLE

An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. An example of an irretrievable loss might be where a type of vegetation is lost due to road construction. Benthic organisms within the borrow area and beach fill area that would be eliminated during construction would be irretrievably lost for a period of time. However, the high rate of repopulation

expected from these organisms reduces the significance of the loss. Impacts from the placement of the pipeline which are temporary (soft corals, sponges, small hard corals, benthic invertebrates, etc.), would be an irretrievable loss of that resource for the period of time it takes to recover.

4.19 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Species of relatively non-motile infaunal invertebrates that inhabit the borrow area will unavoidably be lost during dredging. Those species that are not able to escape the construction area are expected to recolonize after project completion. There would be an unavoidable reduction in water clarity and increased turbidity and sedimentation. This would be limited to the immediate areas of dredging, beach fill operations and breakwater construction. This impact will be temporary and should disappear shortly after construction activities cease. There would also be unavoidable impacts to hardground benthic organisms due to placement of pipelines across the nearshore reef. Measures will be implemented to minimize these impacts and any impacts that do occur will be mitigated.

4.20 LOCAL SHORT-TERM USES AND MAINTENANCE/ENHANCEMENT OF LONG-TERM PRODUCTIVITY

We recognize that protection of the shoreline is a continual effort. No acceptable and permanent one-time fix has been identified (see section 2.0 on alternatives). Using periodic renourishment is an ongoing effort. However, with the proposed features the renourishment frequency would be reduced. With the proposed action, we expect to approach an average 10-year cycle for beach renourishment for the entire segment. Renourishment efforts have a temporary and short-term impact on the biological resources on and near the shore. Removal of material from offshore borrow sites has a long-term impact on the nature of the borrow site. However, these impacts are not substantial since there are no special resources within the borrow site and some resources remain after dredging.

4.21 INDIRECT EFFECTS

Shore protection efforts by the Corps of Engineers do not generally encourage shore front development. The purpose of these projects is generally to protect existing property, structures, or other valuable resources, which already exist near the shoreline and are threatened by storm or erosion damage. Property protection benefits must be substantial enough to justify the cost of the effort. Some "fill-in" and replacement development could be expected and would be encouraged by a continual shore protection effort.

4.22 COMPATIBILITY WITH FEDERAL, STATE, AND LOCAL OBJECTIVES

The proposed action is consistent with the state's Coastal Zone Management plan (see Appendix B on consistency determination). We expect the preferred alternative to be consistent with Federal, State and local plans and objectives.

4.23 CONTROVERSY

A recent renourishment at Sunny Isles using a borrow site off shore of Golden Beach was subject to a court ordered injunction. While this injunction was dissolved, continued interest in the Sunny Isles segment remains. In addition, the proposed modification involves features not previously used in Dade County.

4.24 uncertain, UNIQUE, OR UNKNOWN RISKS

As stated above, the proposed modification involves some features not previously used. These include a transition fill off Golden Beach, an advanced maintenance berm off Sunny Isles, and a breakwater at the Sunny Isles boundary with Golden Beach. These features have been extensively tested with models ([refer to DM]). We do not expect any undesirable effects. However, in the unlikely event of unacceptable impacts, we would take corrective measures as required by permit, law, or otherwise determined appropriate.

4.25 PRECEDENT AND PRINCIPLE FOR FUTURE ACTIONS

The transition fill and geotextile breakwater are new features for the project. Breakwaters have been used at various places in Florida. Most have been hard structures such as stone or prefabricated modules. Performance of these has been mixed. Placement, spacing, and orientation are important factors in their success. If the proposed action performs as expected, further use of these features could be indicated for Dade County and other coastal areas.

4.26 ENVIRONMENTAL COMMITMENTS

The U.S. Army Corps of Engineers and contractors commit to avoiding, minimizing or mitigating for adverse effects during construction activities by including the following commitments in the contract specifications:

(1) Inform contractor personnel of the potential presence of sea turtles and manatees in the project area, their endangered status, the need for precautionary measures, and the Endangered Species Act prohibition on taking sea turtles, manatees and other threatened or endangered species.

(2) Take precautions during construction activities to insure the safety of the manatee. To insure the contractor and his personnel are aware of the potential presence of the manatee in the project area, their endangered status, and the need for precautionary measures, the contract specifications would include the standard protection clauses concerning manatees. The contractor would instruct all personnel associated with the construction of the project about the presence of manatees in the area and the need to avoid collisions with manatees. All vessels associated with the project shall operate at 'no wake' speeds at all times while in shallow waters, or channels, where the draft of the boat provides less than three feet clearance of the bottom. Boats used to transport personnel shall be shallow draft vessels, preferably of the light-displacement category, where navigational safety permits. Vessels transporting personnel between the landing and any workboat shall follow routes of deep water to the extent possible. Shore crews or personnel assigned to the disposal site for the workshift shall use upland road access if available. All personnel would be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Endangered Species Act and the Marine Mammal Protection Act. The contractor shall be held responsible for any manatee harmed, harassed, or killed as a result of the construction of the project. If a manatee is sighted within 100 yards of the dredging area, appropriate safeguards would be taken, including suspension of dredging, if necessary, to avoid injury to manatees. The contractor shall keep a log of all sightings, collision, injuries, or killings of manatees during the contract period. Any manatee deaths or injuries will be immediately reported to the Corps of Engineers and the USFWS (Vero Beach Office).

(3) Implement the following measures to minimize adverse effects to sea turtles:

a. Nourished beaches would be plowed to a depth of at least 36 inches within one week following the completion of the entire beach nourishment (or sooner on completed sections) if sand compaction is greater than 500 cone penetrometer units.

b. Nourished beaches would be checked for compaction every 500 feet along the project area. One station shall be at the seaward edge of the dune/bulkhead line (when material is placed in this area); one station shall be located between the dune line and the high water line; and one station shall be located just landward of the mean high water line. At each station three readings would be made at 6, 12, and 18 inch depths three times (three replicates). If any two or more adjacent stations have compaction at the same depth greater than 500 cone penetrometer units, the area would be plowed to a depth of at least 36 inches immediately prior to April 1. This process would be completed for three consecutive years following project completion.

c. Nest relocation activities must begin 65 days prior to nourishment activities which occur within the nesting and hatching season (April 1 - November 30) or by April 1, whichever is later. Nest surveys and relocations shall continue through the end of the project or September 30, whichever is earlier.

d. Nest surveys and relocations would be conducted by personnel with prior experience and training in nest survey and relocation procedures, and with a valid Florida Department of Environmental Protection (FDEP) permit.

e. Nests would be relocated between sunrise and 9 a.m. each day, and the relocation would be to a nearby hatchery in a secure setting where artificial lighting would not conflict with hatchling orientation.

f. In the event a turtle nest is dug up by beach construction activities, the contractor shall immediately notify the FDEP permitted individual responsible for nest relocation so that the nest can be moved to the beach hatchery.

g. A report describing the actions taken to implement the terms and conditions shall be submitted to the USFWS within 60 days of completion of the proposed work for each year when activity has occurred. The report shall include the dates of actual construction activities, names and qualifications of personnel involved in nest surveys and relocation activities, descriptions and locations of the hatcheries, nest survey and relocation results and hatching success of the nests.

h. Nourished beaches would be surveyed for escarpments immediately after construction and prior to April 1, for 3 subsequent years. Any escarpments that exceed 18 inches in height and 100 feet length would be leveled by April 1.

i. Measures will be taken to reduce night time beach lighting including: eliminating extraneous lighting to an amount necessary for safe operations and safety of personnel.

j. The drag arms of the hopper dredge will be fitted with a rigid sea turtle deflector draghead, and modified as necessary to eliminate sites of inadvertent entrainment of sea turtles.

k. The inflow to the hoppers will be screened as close to 100% as possible. There will be 100% observer coverage to monitor the screens for evidence of turtle take.

l. To minimize the potential for sea turtle entrainment, the dredge pumps would be shut down before the draghead is lifted off the bottom and would not be turned on until the draghead is placed on the bottom. NOTE: If the actual dredging operation has difficulty with this procedure, the Corps reserves the right to re-consult with NMFS to delete or modify this requirement.

(4) Monitor turbidity at both the dredging and discharge sites. Should monitoring reveal turbidity levels above State standards, outside the allowable mixing zone, work would be suspended until turbidity levels return to within those standards.

(5) Precautions would be implemented during construction to minimize potential impacts to hardground communities adjacent to the borrow area. A 400 foot buffer zone would be established around any hardground areas.

(6) A biological monitoring program to assess possible impacts of dredging and construction operations to reef and live-bottom habitats near the borrow and renourishment area, would be conducted.

(7) Artificial reefs would be constructed to mitigate for adverse impacts to hardground habitat due to the placement of the discharge pipelines.

4.27 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

4.27.1 National Environmental Policy Act of 1969

Environmental information on the project has been compiled and a Draft Environmental Impact Statement, dated October 1997 was prepared and circulated for public review and comment. This Final EIS was prepared based on the results of that coordination. The project is in compliance with the National Environmental Policy Act.

4.27.2 Endangered Species Act of 1973

On June 3, 1994 the Corps submitted a Biological Assessment (BA) to the National Marine Fisheries Service (NMFS) pursuant to Section 7 of the Endangered Species Act. In the BA the Corps had determined that the project would not adversely affect any listed species (whales and pelagic sea turtles) under their jurisdiction. On January 4, 1995 the NMFS concurred with the Corps' no effect determination if hopper dredging takes place during November through April or if a hopper dredge is not employed (see correspondence in Appendix C). Since the time of NMFS January 4 concurrence, they have issued a Regional Biological Opinion (RBO), dated September 25, 1997, concerning hopper dredging along the South Atlantic Coast. The RBO states that from Titusville to Key West, there is a hopper dredging window year round with a requirement that incidental take monitoring is done. In addition, a sea turtle deflecting draghead must be used. On June 3, 1994 the Corps submitted a BA to the U S Fish and Wildlife Service (USFWS) pursuant to Section 7 of the Endangered Species Act that the proposed project may affect nesting sea turtles under their purview (see copy of BA in Appendix C). On October 24, 1996 the USFWS issued a Biological Opinion for Region III of the Coast of Florida Erosion and Storm Effects Study, which includes the project area considered for modifications at Sunny Isles. In an April 4, 1997 letter to the USFWS, the Corps made a determination that the reasonable and prudent measures, and terms and conditions listed in the BO for Dade County applied to the proposed project. In a letter dated May 8, 1997 the USFWS concurred with that determination. In a letter dated December 18, 1997, the Corps requested that the requirement for red filters on the headlights of vehicles and construction equipment, and the requirement for using low pressure sodium lights be removed. The USFWS concurred with this request in a letter dated January 29, 1998. Refer to Appendix C for correspondence. This project was fully coordinated under the Endangered Species Act and is therefore, in full compliance with the Act.

4.27.3 Fish and Wildlife Coordination Act of 1958

This project has been coordinated with the U.S. Fish and Wildlife Service (USFWS). A Coordination Act Report (CAR) dated September 5, 1997 was submitted by the USFWS (refer to Appendix D). There has been no change in the project design or the source of beach fill material since submittal of the CAR. This project is in full compliance with the Act.

4.27.4 NATIONAL HISTORIC PRESERVATION ACT OF 1966 (INTER ALIA)

(PL 89-665, the Archeology and Historic Preservation Act (PL 93-291), and executive order 11593) Archival research, field investigations, and consultation with the Florida State Historic Preservation Officer (SHPO), have been conducted in accordance with the National Historic Preservation Act, as amended; the Archeological and Historic Preservation Act, as amended and Executive Order 11593. Refer to Section 4.12 for results of SHPO consultation. The project will not affect historic properties included in or eligible for inclusion in the National Register of Historic places. The project is in compliance with each of these Federal laws.

4.27.5 Clean Water Act of 1972

The project is in compliance with this Act. Application for a Section 401 water quality certification has been submitted to the Florida Department of Environmental Protection. All State water quality standards would be met. A Section 404(b) evaluation is included in this report as Appendix A. A public notice was issued on October 29, 1997 and a public hearing was held on November 18, 1997 that satisfied the requirements of Section 404 of the Clean Water Act.

4.27.6 Clean Air Act of 1972

Refer to Section 4.8 in the EIS for a discussion on the compliance with the Clean Air Act General Conformity Rules. No air quality permits would be required for this project. This project has been coordinated with U.S. Environmental Protection Agency (EPA) and is in compliance with Section 309 of the Act. The draft EIS was forwarded to EPA for their review.

4.27.7 Coastal Zone Management Act of 1972

A federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as Appendix B. State consistency review was conducted during the coordination of the draft EIS.

4.27.8 Farmland Protection Policy Act of 1981

No prime or unique farmland would be impacted by implementation of this project. This act is not applicable.

4.27.9 Wild and Scenic River Act of 1968

No designated Wild and Scenic river reaches would be affected by project related activities. This act is not applicable.

4.27.10 Marine Mammal Protection Act of 1972

Incorporation of the safe guards used to protect threatened or endangered species during dredging and disposal operations would also protect any marine mammals in the area, therefore, this project is in compliance with the Act.

4.27.11 Estuary Protection Act of 1968

No designated estuary would be affected by project activities. This act is not applicable.

4.27.12 Federal Water Project Recreation Act

The principles of the Federal Water Project Recreation Act, (Public Law 89-72) as amended, have been fulfilled by complying with the recreation cost sharing criteria as outlined in Section 2 (a), paragraph (2). Another area of compliance includes the public beach access requirement on which the renourishment project hinges (Section 1, (b)).

4.27.13 Fishery Conservation and Management Act of 1976

The project has been coordinated with the National Marine Fisheries Service (NMFS) and is in compliance with the act (refer to correspondence in Appendix C from NMFS).

4.27.14 Submerged Lands Act of 1953

The project would occur on submerged lands of the State of Florida. The project has been coordinated with the State and is in compliance with the act.

4.27.15 Coastal Barrier Resources Act and Coastal Barrier Improvement Act of 1990

There are no designated coastal barrier resources in the project area that would be affected by this project. These acts are not applicable.

4.27.16 Rivers and Harbors Act of 1899

The proposed work would not obstruct navigable waters of the United States. The proposed action has been subject to the public notice, public hearing (held Nov. 18, 1887), and other evaluations normally conducted for activities subject to the act. The project is in full compliance.

4.27.17 Anadromous Fish conservation Act

Anadromous fish species would not be affected. The project has been coordinated with the National Marine Fisheries Service and is in compliance with the act.

4.27.18 Migratory Bird Treaty Act and Migratory Bird Conservation Act

No migratory birds would be affected by project activities. The project is in compliance with these acts.

4.27.19 Marine Protection, Research and Sanctuaries Act

The term "dumping" as defined in the Act (3[33 U.S.C. 1402](f)) does not apply to the disposal of material for beach nourishment or to the placement of material for a purpose other than disposal (i.e. placement of rock material as an artificial reef or the construction of artificial reefs as mitigation). Therefore, the Marine Protection, Research and Sanctuaries Act does not apply to this project. The disposal activities addressed in this EIS have been evaluated under Section 404 of the Clean Water Act.

4.27.20 E.O. 11990, Protection of Wetlands

No wetlands would be affected by project activities. This project is in compliance with the goals of this Executive Order.

4.27.21 E.O. 11988, Flood Plain Management

The project is in the base flood plain (100-year flood) and has been evaluated in accordance with this Executive Order. Refer to Beach Erosion Control and Hurricane Protection, Dade County, Florida, North of Haulover Beach Park dated April 1985. Project is in compliance.

4.27.22 E.O. 12898, Environmental Justice

The proposed action would not result in adverse human health or environmental effects, nor would the activity impact subsistence consumption of fish or wildlife. Project is in compliance.

4.27.23 E.O. 13089, Coral Reef Protection

The proposed action may affect U.S. coral reef ecosystems as defined in the Executive Order. Precautions would be implemented during construction minimize impacts. Artificial reefs would be constructed to mitigate for any reef impacts associated with the placement of discharge pipelines. Refer to Sections 4.4.2, 4.4.6.1, 4.19 and 4.26 (5), (6) & (7) in the EIS. Project is in compliance.

5. LIST OF PREPARERS

Name	Discipline/ Expertise	Role in EIS Preparation	Experience
Kenneth R. Dugger	Chief, Environmental Coordination Section	Supervisor	11 years Corps biologist at Savannah & Jacksonville Districts, 5 years Puerto Rico DNR biologist, 2 years EPA

			biological technician
Michael Dupes	Biology	Biological impact assessment; principle writer	4 years water quality 10 years Natural Res. Mgmt, 7 years environmental studies; Jacksonville District
Janice E. Adams	Archeology	Historic properties impact assessment	11 years historic properties management
Steve Blair	Marine Biology	Hardground/softground affected environment and impact assessment	9 years macro-algal taxonomy at Harbor Branch 10 years in natural resource management. & environmental impact assessment at DERM.
Paul C. Stevenson	Landscape Architect	Aesthetic and recreation analysis	7 years Jacksonville District, 5 years private practice, Registered Landscape Architect - Florida
Tom Martin	Coastal Engineering	Technical study manager economic analysis, and and economic analysis	15 years- engineering, study management - Jacksonville District. Registered professional engineer, Florida.
Doug Rosen	Coastal Geology	Geotechnical analysis of borrow area sands	19 years- geotechnical analysis, Jacksonville Performed engineering designDistrict

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6. PUBLIC INVOLVEMENT

6.1 SCOPING AND DRAFT EIS

Scoping letters for the proposed action were sent on April 21, 1993 to Federal, State, county, other local authorities, and other known interested parties and organizations. A copy of this letter appears in Appendix C. The Notice of Intent (NOI) to prepare a Draft Environmental Impact Statement (DEIS) appeared in the Federal Register on January 21, 1997. An amendment to the NOI was published in the Federal Register on April 7, 1997. In addition, the NOI and the amendment were mailed to interested and affected parties by letters dated January 31, 1997 and April 9, 1997 respectively. A copy of the NOI, NOI amendment and transmittal letters can be found in Appendix C as well as copies of any letters of comment/response received. A scoping meeting was held in Sunny Isles on September 23, 1997. A public hearing was also held in Sunny Isles on November 18, 1997. Copies of any comments or questions submitted in writing at, or subsequent to, those meetings are included in Appendix C. A copy of the transcript of the public hearing is also included in Appendix C. A Notice of Availability (NOA) of the DEIS was sent to interested parties on October 29, 1997 (Appendix C). A notice also appeared in the Federal Register on November 14, 1997 (Appendix C).

6.2 AGENCY COORDINATION

The proposed project has been coordinated with the following agencies: U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Environmental Protection Agency, Florida State Clearinghouse, Florida State Historic Preservation Officer (SHPO), Florida Game and Fresh Water Fish Commission, and the Florida Department of Environmental Protection.

6.3 LIST OF STATEMENT RECIPIENTS (DRAFT EIS)

The DEIS was circulated to Federal, State, and local agencies, interest groups and individuals for review and comment by letter dated November 4, 1997. A list of those that were sent copies is attached to that letter and can be found in Appendix C.

6.4 COMMENTS RECEIVED

Letters of comment on the Draft EIS were received from the U.S. Environmental Protection Agency (EPA); U.S. Department of Commerce; National Geodetic Survey (NGS); National Marine Fisheries Service (NMFS); Florida Department of Community Affairs, State Clearinghouse; Florida Department of Environmental Protection (FDEP); Florida Department of State, Division of Historical Resources, State Historic Preservation Officer (SHPO); South Florida Regional Planning Council (SFRPC), Town of Golden Beach; and Mr. Sheldon J. Schlesinger. These letters can be found in Appendix C.

Pertinent comments with the Corps responses are listed below.

(1) EPA letter dated December 23, 1997.

Comment: Third paragraph expressed concern about the longevity and durability of the proposed geo-textile tube breakwater and the potential for vandalism.

Response: Monitoring information on geo-textile tube structures placed in Europe and the United States indicates that 3-4 years is a typical lifespan when the geo-textile fabric is subject to ultraviolet ray exposure, as in the case of unprotected tubes placed above the waterline in applications such as groins or revetments. Ultraviolet exposure does not occur below about 2-3 feet of water depth. Experience with tubes placed entirely below the water surface indicates that degradation of the fabric occurs at a much slower rate and the lifespan may exceed 10 years. These monitoring data suggest that an ongoing maintenance, repair, and replacement program would be required. The addition of a beach fill transition will extend the period between renourishment intervals. However, to achieve the desired 10-year renourishment interval construction of a breakwater in addition to the advance maintenance berm and beach fill transition is required. The possibility of vandalism to the tubes will be reduced by placing the structures out of sight (under water) and beyond the seaward limit of the permitted swimming area.

Comment: The fourth paragraph expressed concern for the potential of the structure to move during rough weather events.

Response: In order to minimize the possibility of movement, the structure would be constructed using large flat bags or tubes, as opposed to round tubes which would be more susceptible to rolling.

Comment: Paragraphs five and six wanted to know about additional measures that could be implemented if unacceptable spreading losses continued, expressed concern about the potential for existing buffer areas currently protecting biologically sensitive resources being excavated in the future, and the viability of using non-native sand sources.

Response: Several options are available if unacceptable spreading losses should continue following project construction. Modification of the breakwater could increase beach fill performance, and would be accomplished either by raising the crest elevation or lengthening the structure, or both. Placement of non-domestic sediment and beach scraping (moving material from accreted reaches of beach to erode areas) may also be considered. The depletion of borrow areas offshore of Dade County continues to be a primary concern. The existing buffer areas were developed to protect hardground resources adjacent to the borrow areas. The Corps does not plan to adjust these buffer areas to obtain sand for future renourishments. We are currently investigating other sources, such as, foreign carbonate sand and upland sand to fulfill future renourishment needs in Dade County.

(2) NGS letter dated November 11, 1997.

Comment: NGS expressed concerns about project activities affecting geodetic control monuments that might be present in the project area. They also indicated that the proposed breakwater would have to be shown on nautical charts 11467 and 11468. They requested the Jacksonville District to provide them with as built plans, once the project is completed.

Response: The project will be coordinated with NGS to ensure that control monuments are not affected. The Corps will also provide them with the information needed to update the nautical charts.

(3) NMFS letter dated December 9, 1997.

Comment: NMFS expressed concern about the cumulative impact of multiple beach projects on infaunal communities on the beach and within the borrow areas.

Response: Recruitment of benthic organisms for the renourished beach would be, at least in part, from the updrift beach. The expressed concern is that if the updrift beach itself is recovering from a recent renourishment, its ability to supply organisms to the downdrift beach would be hampered. It should be noted that renourishment of two adjoining project segments is rarely within one year of each other. Also, recruitment of some benthic organisms is very rapid (within a few months) while the recruitment time for other organisms may be much longer. Recruitment could come from more distant sources than the adjacent beach. Seasonally shifting current and shoreline drift patterns in Dade County could allow for recruitment from either north or south of the renourished beach. It is reasonable to assume that these benthic organisms are adapted to a high energy environment and, for the most part, would quickly recolonize a beach. In addition to the lack of evidence of significant cumulative impact from renourishing adjacent beaches, no practical means was offered to avoid or reduce whatever cumulative impact there might be. We continue to believe these impacts to be minor relative to the impacts of the project on other resources identified in the EIS and for which we propose extensive mitigation.

For the Dade County Project, offshore borrow areas (i.e. SGC, SGC-2 and SGC-extension) are designed for a specific renourishment event. Once used for a specific renourishment they are essentially depleted of sand that can be used for beach fill and would not be used in the future. Although there would not be enough sand left in the borrow area for renourishment purposes, there would be enough sand remaining to support the benthic organisms that would repopulate the area after dredging. Since a borrow area would only be dredged once, we do not anticipate any cumulative impacts to the benthic communities within the borrow areas.

Comment: NMFS expressed concern that the cumulative impacts on water quality from turbidity were not addressed.

Response: The material to be dredged was selected due to its similarity to the material currently existing on the beaches of Dade County, which averages in the range of five to six percent fines. The suspension and resuspension of fines is a result of the natural coastal processes associated with an eroding beach. Since the renourishment material is similar to the existing beach, it is reasonable to assume that it would not behave much differently than the existing beach with respect to natural process of sorting and resuspending fines. In addition, it is reasonable to assume that much of the suspended fines are swept away by currents until reaching calmer waters (deeper waters, holes, or protected shallow waters) but not likely on top of hardgrounds or reef organisms or other high energy environments.

Comment: NMFS was concerned that monitoring sedimentation impacts to hard bottom habitats was not adequately addressed in the draft EIS. They recommended that a new approach to monitoring for sedimentation be used, as recommended in the Final Fish and Wildlife Coordination Act Report.

Response: As discussed in Section 4.4.6.1 (5th paragraph) of the draft EIS, an intensive reef monitoring program would be conducted as part of the project. Monitoring will be conducted during construction to determine sedimentation rates and accumulation levels on the reefs adjacent to the borrow area. Visual inspections of hardground adjacent to the borrow area will also be performed to look for any indicators of turbidity and/or sedimentation impacts. Marine biologists with experience in impact assessment would conduct the surveys and examine the benthic organisms for pre-defined indicators of stress or imminent impact. The monitoring plan for this project will be similar to what was conducted during the Sunny Isles and Miami Beach renourishment completed in July 1997, and what is proposed for the renourishment at Surfside and South Miami Beach. A copy of the Draft Comprehensive Monitoring Plan for the 2nd Renourishment at Surfside and Southern Miami Beach has been included, for reference, in the EIS as Appendix G. The monitoring components to be addressed in the monitoring plan for this project will be the same as those contained in the monitoring plan in Appendix G. The locations of specific monitoring sites would be determined at a future date.

Our experience in Dade County has shown that measured sedimentation rates of 200 mg/cm^2/day may not adequately indicate impact to hardbottoms and reef organisms. As part of the reef monitoring during construction, sedimentation rates would be measured. However, we find that diver monitoring of the reefs and other protection measures indicated in the EIS are more sensitive and more appropriate to protect the hardbottom and reef organisms off Dade County from excessive sedimentation. During the last renourishment at Sunny Isles and Miami Beach, we never experienced a sedimentation rate at or above the 200 mg/cm^2/day (seven day average). On at least one occasion, DERM detected sedimentation stress on the reef and the dredge was moved to another part of the borrow area. This stress was detected before ever reaching the 200 mg/cm^2/day threshold.

(4) FDEP letter dated December 16, 1997.

Comment: FDEP stated concerns about direct and indirect dredge impacts to reefs and associated organisms, and the need to carefully manage dredging operations and to monitor for reef impacts.

Response: Anticipated impacts to hardground/reef communities as well as procedures that would be implemented to eliminate, minimize or mitigate for impacts are discussed in Sections 4.4.2, 4.4.6.1. and 4.26(4)-(7) in the EIS.

Comment: FDEP listed several potential impacts that should be included in Table 1.

Response: Table 1 is a summary of the potential impacts associated with the alternative plans considered and does not list all potential impacts. Potential impacts are discussed in detail in Section 4. ENVIRONMENTAL EFFECTS. 1) The potential for scarping to interfere with sea turtle nesting is discussed in Section 4.4.2 of the EIS. Measures to be implemented that will minimize scarping impacts are discussed in 4.26(3)h. 2) We agree that improperly designed and/or placed groins could interfere with sea turtle nesting and hatchling emergence. Section 4.3.3 in the final EIS has been revised accordingly. 3) The geo-textile breakwater will be designed to have at least 3-4 feet of water over the top

at low tide. It is also designed to be in two segments (each 375' long) with a 250' gap in between. Because the breakwater will be segmented and submerged it is not expected that it will interfere with the movement of female sea turtles to shore to nest, or with the egress of hatchlings heading offshore. 4) No appreciable vegetated dune system exists within Sunny Isles, due to the extensive shoreline development(Section 3.2). No work will be performed in vegetated upland areas or in what little vegetated dune does exist (Section 4.2.2).

Comment: Page 19, paragraph 3, line 1 - Loggerhead nesting commences in late April in Dade County. Leatherback sea turtles, which begin nesting in March, have also nested on Dade County beaches, and should be considered for any activity proposed for March through May.

Response: The final EIS has been revised to change the commencement of loggerhead nesting from May to late April. The EIS has also been revised to include a discussion on leatherback sea turtles. Although leatherback turtles are know to nest in Dade County, records on nesting (Meylan et. al., 1995) show that the earliest documented leatherback nest was in mid April (April 11, 1992). During the nesting season, the Dade County Department of Parks and Recreation conduct daily nesting surveys and will conduct the surveys required for this project. These surveys begin on April 1 of each year. Refer to Section 3.3.1 in the EIS.

Comment: Listed several terms and conditions to be incorporated into the plan to ensure marine turtle protection.

Response: Most of the terms and conditions listed in the FDEP letter are consistent with the terms and conditions provided by the USFWS in their Biological Opinion for this project. These are addressed in Section 4.26 ENVIRONMENTAL COMMITMENTS and in the Coast of Florida Study (COFS) Biological Opinion as subsequently amended. In those situations where the terms and conditions are not consistent, those provided by the USFWS will be followed. Refer to the COFS Biological Opinion dated October 24, 1996, Corps' letters dated April 4, 1997 & December 18, 1997, and USFWS letters dated May 8, 1997 & January 29, 1998. These references are included in Appendix C of the EIS.

Comment: Manatee Protection.

Response: Standard conditions for manatee protection will be implemented for this project. Refer to Section 4.26(1)&(2) in the EIS.

(5) SFRPC letter dated December 5, 1997.

Comment: SFRPC stated concerns about the impacts the geo-textile breakwater would have on benthic resources and downdrift erosion to adjacent shorelines.

Response: The breakwater will be constructed on a sand bottom away from hardground benthic communities. Precautions to minimize turbidity and sedimentation during filling of the geo-textile tubes would be implemented (see EIS, Section 4.4.4.). The project is proposed to stabilize the north end of the Sunny Isles beach fill. During the design process the effects of all alternative plans were examined over the entire lengths of Sunny Isles and Golden Beach. The results of shoreline modeling indicate the proposed breakwater design will have no adverse impacts to adjacent shorelines (see EIS, Section 2.1.3).

(6) Letter from the Town of Golden Beach dated November 20, 1997 (See attached written comments dated November 19, 1997 from Dr. Kevin Bodge, P.E., consulting engineer to the Town of Golden Beach).

Responses are numbered to coincide with comment numbers.

Comment 1: The project's north taper along Golden beach ...

Response: Each construction method (mechanical vs. hydraulic) offers advantages and disadvantages. As mentioned in Dr. Bodge's letter, hydraulic construction of the beach fill would result in greater

turbidity during project construction than mechanical placement. Erosion of some existing beach fill could occur as a result of hydraulic placement as Dr. Bodge states, but any material eroded during construction would be replaced by the contractor, since the project requires construction of a specific berm width. In spite of these issues, hydraulic placement offers several advantages to the Town of Golden Beach. Hydraulic fill placement could be accomplished with much lower noise and vibration levels since considerably less earth-moving equipment would be required. Hydraulic placement could also be accomplished much more quickly. Mechanical construction would be limited to periods of lower tide levels, whereas hydraulic placement could proceed at all tide levels, greatly increasing the efficiency and decreasing the time required to complete the operation. Turbidity from the pipeline discharge is reduced by constructing temporary containment dikes which allows a greater percentage of sediment to settle out of suspension. Following completion of a section of beach, the containment dikes are smoothed out.

Comment 2: The slope of the berm crest ...

Response: The berm crest will be sloped downward from elevation +9.0 to +2.6 mean low water using a slope of 1 vertical to 10 horizontal. This is approximately the same slope as the equilibrium front slope of the beach, and should pose no danger or inconvenience to beachgoers. The slope will be placed entirely on the Sunny Isles side of the city limit.

Comment 3a: The length of time to construct the northern taper is of concern.

Response: The length of time to construct the taper (approximately 75,000 cubic yards) is estimated to be about 1 week using hydraulic placement and 24-hour construction, assuming favorable weather. The same operation would require at least 3 weeks with mechanical placement, since mechanical work proceeds at a slower pace and would be suspended altogether during periods of higher tidal levels.

Comment 3b: ... is the Corps willing to consider visual (rather than audible) back-up signals on the Contractor's beach vehicles?

Response: Regulations require the use of audible back-up alarms on all construction equipment; visual signals cannot be substituted. Hydraulic placement would require less earth-moving equipment and therefore less noise due to back-up alarms.

Comment 4: The geotube breakwater should be placed within the *water depth* and *freeboard* for which it was designed ...

Response: The breakwater would be constructed in approximately 8 to 10 feet of water, and would rise to within 3 feet of the surface at mean low water. The proposed breakwater site is located 480 feet east of the ECL, but due to the relatively flat offshore profile in this depth range, some variability in onshore/offshore location of the breakwater is possible. The most recent survey available of the project area at this time was performed in November 1996. A county-wide beach profile survey of all DNR monuments is currently underway; this survey will be used to prepare permit drawings when available. More detailed surveys will be taken at a later date for the preparation of Plans and Specification (P&S).

Comment 5a: The "zone" of possible geotube placement ...

Response: The GENESIS computer modeling presented in the 1995 Design Memorandum for modifications to the Sunny Isles segment of the Federal project indicated that optimal breakwater performance occurred with the proposed structure located about 480 feet seaward of the ECL. The water depth at this location was about 8 feet, based on surveys taken at that time. Examination of two more recent surveys (June 1996 and November 1996) shows that water depths 480 feet seaward of the ECL have remained relatively constant since that time. Surveys of monuments DNR –7 and DNR-8 at the north end of Sunny Isles show that the water depths 480 feet seaward of the ECL at both profile locations were 8 feet in June 1996 and 6 feet in November 1996. Water depth fluctuations at these locations appear to be due to seasonal adjustment of the profile caused by cross-shore transport of material in response to storm waves transporting material seaward into the bar system. The project's P&S will indicate exact placement location in terms of distance seaward of the ECL and water depth, based on the surveys taken for the P&S. At this time it appears that the structures can still be placed

approximately 480 feet seaward of the ECL. The location would be modified only if significant changes to the offshore profile occur.

Comment 5b: The proximity of the geotube location(s) to the nearest patch reefs should be re-examined based upon recent surveys.

Response: Based on breakwater construction 480 feet seaward of the ECL, the shortest distance between the reef and breakwater is 360 feet. This and all other aspects of breakwater placement will be re-examined during the preparation of P&S using the P&S survey.

Comment 6: The beach profile monitoring program should be reasonably frequent in time and space, ...

Response: A beach profile monitoring program is typically required of all beach renourishment projects. The monitoring program described in Dr. Bodge's comment #6 would be typical for a beach fill with shoreline stabilization structure, with the following additions:

a) A five-year monitoring period is usually specified by the DEP. This monitoring period could be extended if significant shoreline changes are still occurring at the end of the monitoring period. In addition to DEP-required monitoring surveys, county-wide condition surveys of the project are taken periodically and could be used to monitor the breakwater project area long after the monitoring program has concluded .

b) It is agreed that a higher density of profile lines should be used near the breakwater, and that additional profiles north of the project area should be surveyed for control purposes. Existing DNR survey monuments should be used to the greatest extent possible, to allow comparisons with the historical database. Some of the intermediate monuments suggested by Dr. Bodge could be shifted slightly to coincide with existing monuments. Specifically, monument 6A would be used instead of 6.5, 7A would be used instead of 7.5, and 8A would be used instead of 8.5. These established intermediate monuments are located close to the midpoints between the adjacent DNR primary monuments, and would provide a better historical comparison of pre- vs. post- project effects. The remaining intermediate monuments would be established as closely to the midpoint between adjacent profile lines as possible, with the exceptions of 7.25 and 7.75, which would be located at the midpoint of the north and south breakwater segments, respectively. Profile line spacing would correspond roughly (but not exactly) to the proposed 250-foot and 500-foot spacing between profile lines.

c) It is generally agreed that the breakwater and adjacent areas should be surveyed more frequently at the beginning of the monitoring program, and less frequently as the project area stabilizes. The exact monitoring program profile line layout and survey schedule will be determined during the permitting process. The monitoring survey schedule proposed by Dr. Bodge is not atypical for this type of project and will be considered.

d) Existing DNR monuments (1000-foot spacing) would be surveyed along the remaining 2.5-mile project length to the south, on an annual basis.

e) All profiles will extend 2000 feet seaward from each monument for compatibility with the historical database.

Comment 7: The project permit should stipulate "triggers" that require modification or removal of the geotube breakwaters if...

Response: Predetermined conditions for removal of ineffective or damaging coastal structures have been used in the past, and would probably be required by the State of Florida. Survey data will be available for public inspection.

Comment 8: Frequent regular inspection of the breakwater is recommended ...

Response: Divers from Dade Environmental Resource Management (DERM) will inspect the breakwater periodically to assess the condition of the geo-textile fabric for rips and tears, and to measure any

cross-shore movement.

Comment 9: At this time, The Town is adamant that no erosion control line be required or established along Golden Beach as a result of the project.

Response: There is no intention on behalf of the Jacksonville District, Corps of Engineers, to establish an Erosion Control Line along the Town of Golden Beach for the proposed project.

Comment 10: On behalf of the Town, I would like the opportunity to examine the construction Plans & Specifications ...

Response: The opportunity for Dr. Bodge to examine the P&S during BCO review should be coordinated with the District's Engineering Division and Office of Counsel.

(7) Letter from Sheldon J. Schlesinger, P.A., dated November 20, 1998.

Comment: Section I "Significant Impacts." Subsections "Sea Turtles," "Coral Reefs," "Wildlife," and "Water Quality."

Response: The potential impacts to endangered species, fish and wildlife resources, and water quality are discussed at length in Section 4. ENVIRONMENTAL EFFECTS, in the Draft EIS. Procedures to eliminate or minimize project related impacts are also addressed. Refer to EIS sections 4.1, 4.2, 4.3, 4.4, and 4.6.

Comment: Section I "Significant Impacts." Subsection "Beaches."

Response: The proposed project will reduce water depths and beach erosion in the vicinity of the breakwater, and will have a negligible impact at greater distances north and south of the structure. The more stable beach configuration provided by the structure will reduce the risk of storm damage to the adjacent beaches. The littoral transport will be reduced slightly in the lee of the structure, and will not be significantly affected elsewhere. Tidal water flow is negligible along the open coast away from tidal inlets. Tidal water flow in the vicinity of the project area will therefore not be affected. Provisions will be made to prevent damage that might be caused by construction equipment.

Comment: Section I "Significant Impacts." Subsection "Houses and Property."

Response: The shoreline along southern Golden Beach may accrete slightly; no other shoreline changes are anticipated. Shoreline changes throughout the remainder of Golden Beach due to the breakwater and beach fill will be negligible. Noise and vibration limits will be placed on the operation of construction equipment in order to prevent damage to private residences.

Comment: Section I "Significant Impacts." Subsection "Individuals' Life and Safety."

Response: Storm damages will be reduced, not increased by the proposed project. The construction area will be restricted to beach users in accordance with required safety guidelines. The proposed structure will be located seaward of the allowable swimming area, thus preventing possible injuries to swimmers. Dangers to the boating public would be minimized by marking the structure with small buoys and/or publishing a "Notice to Mariners" as required by the U.S. Coast Guard.

Comment: Section I "Significant Impacts." Subsection "Recreation."

Response: Impacts on recreation are discussed in section 4.11 of the EIS. Reefs, beaches and wildlife would not be destroyed as implied in this comment. All precautions will be taken to avoid or minimize any impacts to natural resources and these are discussed in the EIS. There would be some disruption of normal recreational activities in the immediate vicinity of construction during the time of construction. Once construction is complete, recreation would return to normal.

Comment: Section I "Significant Impacts." Subsection "Personal, Corporate and Municipal Liability."

Response: The Corps does not concur that constructing the proposed project would subject hotels, landowners and surrounding municipalities to liability exposure.

Comment: Section I "Significant Impacts." Subsection "Infringement on the Rights of Private Property Owners."

Response: The breakwater would be submerged at all times, and would therefore present no degradation to the aesthetics of the project area. Post-nourishment beach berm widths would not differ significantly from berm widths along the Sunny Isles segment of the project. Marker buoys(if required) would not differ significantly in size and shape from the buoys currently placed along the Sunny Isles shoreline to mark the seaward limit of the swimming areas. The buoys would not be large enough to obscure the view or impact property values of Golden Beach residents.

Comment: Section I "Significant Impacts." Subsection "Ineffectiveness and Uncertainty."

Response: Breakwaters have been proven to be an effective means of increasing shoreline stability in applications throughout the world. The use of such structures is not considered "experimental." Measures will be employed to stabilize the structure to prevent movement during storm conditions.

Comment: Section I "Significant Impacts." Subsection "Monitoring and Assessment."

Response: Monitoring of the structure and the adjacent beaches would be required by the State of Florida to implement this project. Should the structure perform unsatisfactory, it would be removed or modified as appropriate.

Comment: Section I "Significant Impacts." Subsection "Alteration of Historical Protection."

Response: No alterations of the offshore reef are proposed, and no significant impacts to the reef are expected as a result of this project. A primary design objective was to avoid the interruption of the natural littoral processes along the project area, including the adjacent shorelines north and south of the submerged breakwater. The only modification to the existing littoral processes is a slight reduction of wave energy landward of the structure, which will reduce the high erosion rates currently observed in this area.

Comment: Section I "Significant Impacts." Subsection "Other."

Response: Cumulative impacts are discussed in Section 4.17 of the EIS.

Comment: Section II "Evaluations of Alternatives."

Response: All feasible and reasonable alternatives to this project were evaluated in the Jacksonville District's study *Dade County Florida, Shore Protection Project, Modifications to Sunny Isles Segment, Design Memorandum, Addendum III*. These alternatives are also discussed in Section 2. ALTERNATIVES, in the Draft EIS. Alternatives included the "no-action" plan, the use of groins, revetments, advanced nourishment, transitions, perched beaches, and numerous breakwater configurations. The recommended plan met the design objectives with no adverse impacts to the surrounding beaches. The suggested alternative of condemning the upland property along northern Sunny Isles was not considered to be a feasible alternative. The proposed solution represents the lowest cost practical method of stabilizing the shoreline along the northern portion of Sunny Isles. No significant adverse environmental impacts are anticipated from construction of the recommended plan.

Comment: Section III "Additional Federal Statutory and Regulatory Considerations."

Response: Refer to Section 4.27 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS, in the EIS.

Comment: Section II "Procedural Requirements."

Response: This comment indicates that the September 9, 1997 "Intent to prepare DEIS" (for this project)

relies on a scoping letter of April 21, 1993 which was deemed ineffective and inadequate by the U.S. District Court, Southern District of Florida. The fact is, the scoping letter that is referred to is dated April 27, 1993, and is not the scoping letter referenced in the "Intent to prepare DEIS" but relates to a completely separate renourishment activity along a portion of Sunny Isles and Miami Beach. This renourishment was completed during the summer of 1997.

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APPENDIX A - SECTION 404(B) EVALUATION

SECTION 404(b) EVALUATION

PROPOSED MODIFICATIONS AT SUNNY ISLES

DADE COUNTY BEACH EROSION CONTROL

AND HURRICANE PROTECTION PROJECT

DADE COUNTY, FLORIDA

I. Project Description

a. Location. Dade County is located along the Atlantic Coast of Florida. Sunny Isles is located in the northern portion of the county, south of Golden Beach. The proposed work will be performed as a part of the Dade County Beach Erosion Control and Hurricane Protection Project**.** Refer to location map, figure 1, in the Environmental Impact Statement (EIS).

b. General Description. For optimum increases in storm protection along the Sunny Isles coastline, a combination of shore protection measures are currently being studied. The proposed action consists of construction of a 120 foot wide berm (20 ft. design and 100 ft. advanced maintenance), 1500 foot beach fill transition, and two 375 ft segments of geo-textile tubes for the purpose of an offshore breakwater (see figure 1 for location of proposed action). The borrow areas proposed for use for the beach and transition fill is located south of Government Cut and east of Key Biscayne (see figure 1, location map).

c. Authority and Purpose. Initial authorization came from the Flood Control Act of 1968 authorization of the Beach Erosion Control and Hurricane Protection (BEC & HP) Project for Dade County, Florida (see figure 1, site map). In addition, Section 69 of the 1974 Water Resources Act (P.L. 93-251 dated 7 March 1974) included the initial construction by non-Federal interests of the 0.85 mile segment along Bal Harbour Village, immediately south of Bakers Haulover Inlet. The authorized project, as described in HD 335/90/2, provided for the construction of a protective/recreational beach and a protective dune for 9.3 miles of shoreline between Government Cut and Baker's Haulover Inlet (encompassing Miami Beach, Surfside and Bal Harbour) and for the construction of a protective/recreational beach along the 1.2 miles of shoreline at Haulover Beach Park. The Supplemental Appropriations Act of 1985 and the Water Resources Development Act of 1986 (Public Law 99-662) provided authority for extending the northern

limit of the authorized project to include the construction of a protective beach along the 2.5 mile reach of shoreline north of Haulover Beach Park (Sunny Isles) and for periodic nourishment of the new beach. This authority also provided for the extension of the period of Federal participation in the cost of nourishing the authorized 1968 BEC & HP Project for Dade County, which covered 10.5 miles of shoreline extending from Government Cut north to the northern boundary of Haulover Beach Park, from 10 years to the 50-year life of the project.

Nourishment of Dade County Beaches has become a necessity to provide storm protection. The purpose of the project is to prevent or reduce loss of public beach front to continuing erosional forces and to prevent or reduce periodic damages and potential risk to life, health, and property in the developed lands adjacent to the beach.

d. General Description of Dredged or Fill Material.

(1) General Characteristics of Material. Sand from the proposed borrow areas is generally light gray, poorly graded carbonate sand with a trace of silt and gravel sized shell fragments. Silt content in the SGC-2 borrow area ranges from 1.3 to 10.3 percent with an average of 4.5 percent. The composite mean grain size is 0.56 mm. In the SGC extension borrow area the silt content ranges from 0.8 to 9.2 percent with an average of 3.7 percent. The composite mean grain size is 0.62 mm. In both borrow areas, rock fragments from 1 inch to 3 feet in diameter may make up to 5 percent of the material in the borrow area. The use of these borrow areas will require that all rock fragments larger than 1 inch be separated from the sand and disposed of in an approved area offshore. These borrow areas represent high quality beach nourishment sand sources that contain a low amount of silt.

(2) Quantity of Material. Material needed for the 2.5-mile length of Sunny Isles and the 1500-foot transition is estimated at 988,000 cubic yards. Construction of the geo-textile tubes would require approximately 2000 cubic yards of material suitable to fill the tubes. This material may be stockpiled from the borrow source for the beach fill or trucked to the construction site.

(3) Source of Material. The borrow areas proposed for use for the beach and transition fill is located south of Government Cut and east of Key Biscayne (see figure 1, location map).

e. Description of the Proposed Construction Site.

(1) Location. The proposed fill required is a 120 foot berm (20 ft. design + 100 ft. advance maintenance) located along the 2.5 mile length of Sunny Isles. The proposed 1500 foot beach fill transition would be located off of Golden Beach. The proposed geo-textile tube breakwater is proposed for placement in a shore parallel configuration along the northernmost 1050 feet of Sunny Isles, approximately 500 feet seaward of the existing seawall line. The artificial reef site that will be used for rock disposal is located approximately 1.7 miles east of Miami Beach in 100 to 250 feet of water. The State Plane Coordinate for the center of the site is X = 797,915.64 and Y = 538,242.24. Refer to figures 1 and 2.

(2) Size. The proposed fill is a 2.5 mile project segment with a 1500 foot beach fill transition off Golden Beach, and two 375 ft segments of geo-textile tubes for the purpose of an offshore breakwater.

(3) Type of Site. The site for disposal of the sand material is a segment of eroded, sandy, recreational beach and inshore seabed. The site proposed for breakwater construction is a section of sandy offshore seabed. The permitted rock disposal site is a section of sandy offshore seabed.

(4) Type of Habitat. The beach disposal area consists of a currently eroding carbonate and quartz sand beach and inshore seabed. The borrow area is characterized by a sandy bottom. There are no known seagrass beds or hardgrounds in the borrow area.

(5) Timing and Duration of Dredging. The exact timing of nourishment is not known. It is anticipated that construction will occur during 1998 or early 1999.

f. Description of Disposal Method. It is anticipated that the material will be obtained from the offshore borrow area using a hopper dredge with pumpout capability. However, it is possible that a Mechanical

(clamshell) dredge loading into a barge with pumpout capability could also be used. Once the material is pumped on the beach, grading will be performed using construction equipment to achieve the desired construction profile.

II. Factual Determinations

a. Physical Substrate Determinations.

(1) Substrate Elevation and Slope. The beach fill will be constructed with a berm elevation of +9.0 feet mean low water and a width of 120 feet. The top of the transition fill will be at mean high water. The front slope of the beach fill and transition will be 1 vertical on 10 horizontal from the berm to mean low water, and 1 on 20 from mean low water to the existing bottom. Refer to figures 3 and 4.

(2) Type of Fill Material. Sand from the borrow area has a high carbonate (shell) content and ranges in size from fine to coarse.

(3) Dredge/Fill Material Movement. The fill material will be subject to erosion by waves with the net movement of fill material to the south.

(4) Physical Effects on Benthos. Some benthic organisms that are not mobile may be lost during dredging and may be covered by the beach fill. Recolonization soon after project completion is expected to replace those organisms that do not survive project construction. It is anticipated that no long-term adverse impacts will occur.

b. Water Circulation, Fluctuation and Salinity Determination.

(1) Water Column Effects. During dredging, beach fill operations, and filling the geo-textile tubes, turbidity will increase temporarily in the water column. If practical, turbidity curtains will be used while the geo-textile tubes are filled to minimize the effects of turbidity and sedimentation. The increased turbidity will be short-term; therefore fill placement will have no long-term or significant impacts, if any, on salinity, water chemistry, clarity, color, odor, taste, dissolved gas levels, nutrients or eutrophication.

(2) Current Patterns and Circulation. Net movement of water is from the north to the south. The project will have no significant effect on existing current patterns, current flow, velocity, stratification, or the hydrologic regime in the area.

(3) Normal Water Level Fluctuations and Salinity Gradients. Mean tidal range in the project area is 3.5 feet with a spring tide range of approximately 4.1 feet. Salinity is that of oceanic water. Fill placement will not affect normal tide fluctuations or salinity.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Disposal Site. There may be a temporary increase in turbidity levels in the project area during dredging and along the beach fill sites during discharge. There may also be a temporary increase in turbidity during rock disposal at the artificial reef site. There may be some disturbance of the bottom sediments as the rock material hits the bottom causing some minimal turbidity. Turbidity will be short-term and localized and no significant adverse impacts are expected. State water quality standards for turbidity outside an allowable mixing zone will not be exceeded.

(2) Effects on the Chemical and Physical Properties of the Water Column. The sea floor at this location is characterized by a large sandy shoal. There would be little, if any adverse effects to chemical and physical properties of the water as a result of the use of the proposed borrow area.

(a) Light Penetration. Some decrease in light penetration may occur in the immediate vicinity of the dredging and beach fill areas. This effect will be temporary, limited to the immediate area of construction, and will have no adverse impact on the environment.

(b) Dissolved Oxygen. Dissolved oxygen levels will not be altered by this project due to the high energy wave environment and associated adequate reaeriation rates.

(c) Toxic Metals, Organics, and Pathogens. No toxic metals, organics, or pathogens are expected to be released by the project.

(d) Aesthetics. The aesthetic quality of the water in the immediate area of the project will be reduced during construction due to increased turbidity. This will be a short-term and localized condition. The placement of clean beach compatible sand on an erosive beach will likely improve the aesthetic quality of the immediate area.

(3) Effects on Biota.

(a) Primary Productivity and Photosynthesis. Primary productivity is not a recognized, significant phenomenon in the surf zone, where a temporarily increased level of suspended particulates will occur. There will be no effect on the nearshore productivity as a result of the proposed beach fill.

(b) Suspension/Filter Feeders. An increase in turbidity could adversely impact burrowing invertebrate filter feeders within and adjacent to the immediate construction area. It is not expected that a short-term, temporary increase in turbidity will have any long-term negative impact on these highly fecund organisms.

(c) Sight Feeders. No significant impacts on these organisms are expected as the majority of sight feeders are highly motile and can move outside the project area.

d. Contaminant Determinations. Material which will be dredged from the proposed borrow site will not introduce, relocate, or increase contaminants at the fill area. The material is clean sand compatible with the existing beach. The material to be deposited at the artificial reef site is clean rock, shell and coral rubble.

e. Aquatic Ecosystem and Organism Determinations. The fill material that will be dredged from the proposed borrow area and used in the beach erosion control project is similar enough to the existing substrate so that no impacts are expected. The materials meet the exclusion criteria, therefore, no additional chemical-biological interactive testing will be required.

(1) Effects on Plankton. No adverse impacts on autotrophic or heterotrophic organisms are anticipated.

(2) Effects on Benthos. The beach fill will bury some benthic organisms. Benthic organisms found in the intertidal areas along the project beach are adapted for existence in an area with considerable substrate movement, thus most will be able to burrow up through the fill material. Recolonization is expected to occur within a year after construction activities cease. No adverse long-term impacts to non-motile or motile benthic invertebrates are anticipated. Similar impacts to benthic organisms within the area to be dredged are expected. Placement of the discharge pipeline across the nearshore hardbottom will impact a portion of the benthic community. Any impact to the hardbottom community as a result of placing the pipeline will be mitigated. Refer to Section 4.4.2 in the EIS.

(3) Effects on Nekton. No adverse impacts to nektonic species are anticipated.

(4) Effects on the Aquatic Food Web. No adverse long-term impact to any trophic group in the food web is anticipated.

(5) Effects on Special Aquatic Sites.

(a) Hardground and Coral Reef Communities. There are no hardground or coral reef communities located in the immediate nearshore area that would be impacted by beach fill activities. The proposed offshore borrow area is located near hardground communities. Dredging activities could impact these areas by mechanical destruction and/or by sedimentation. To minimize the potential for impacts to these communities the borrow area has been designed to include buffer zones adjacent to the hardgrounds in

which dredging will not be allowed. The edge of the hardgrounds will be marked with buoys to minimize the chance of encroachment by the dredge. A biological monitoring program will be implemented before, during and after construction to determine if any impacts have occurred. The placement of rock and rubble at the artificial reef site will provide a suitable substrate for the colonization of sessile benthic organisms, thus, over a period of time, creating hardbottom community. Discharge pipelines used to pump the sand from the dredge to the beach will be placed across the nearshore hardbottom communities at two locations. The same pipeline corridor used for the renourishment at Sunny Isles in 1997 will be used for this project. Any impacts to the hardbottom community would be appropriately mitigated by constructing an artificial reef. Refer to Section 4.4.2 in the EIS for a more detailed discussion on hardbottom impacts and mitigation.

(6) Endangered and Threatened Species. There will be no significant adverse impacts on any threatened or endangered species or on critical habitat of any threatened or endangered species. Refer to Sections 4.3 and 4.26.2 in the EIS for measures that will be implemented to protect endangered and threatened species.

(7) Other Wildlife. No adverse impacts to small foraging mammals, reptiles, or wading birds, or wildlife in general are expected.

(8) Actions to Minimize Impacts. All practical safeguards will be taken during construction to preserve and enhance environmental, aesthetic, recreational, and economic values in the project area. Specific precautions are discussed elsewhere in this 404(b) evaluation and in the EIS for this project (refer to Sections 4.1, 4.3, 4.4 and 4.6 in the EIS).

f. Proposed Disposal Site Determinations.

(1) Mixing Zone Determination. Clean sand, compatible with the existing beach, would be placed on the beach. Clean rock, shell and coral rubble too large to place on the beach will be deposited in a permitted artificial reef site. This will not cause unacceptable changes in the mixing zone water quality requirements as specified by the State of Florida's Water Quality Certification permit procedures. No adverse impacts related to depth, current velocity, direction and variability, degree of turbulence, stratification, or ambient concentrations of constituents are expected from implementation of the project.

(2) Determination of Compliance with Applicable Water Quality Standards. Because of the inert nature of the material to be dredged, Class III water quality standards will not be violated.

(3) Potential Effects on Human Use Characteristics.

(a) Municipal and Private Water Supplies. No municipal or private water supplies will be impacted by the implementation of the project.

(b) Recreational and Commercial Fisheries. Fishing in the immediate construction area will be prohibited during construction. Otherwise, recreational and commercial fisheries will not be impacted by the implementation of the project.

(c) Water Related Recreation. Beach/water related recreation in the immediate vicinity of construction will be prohibited during construction activities. This will be a short-term impact.

(d) Aesthetics. The existing environmental setting will not be adversely impacted. Construction activities will cause a temporary increase in noise and air pollution caused by equipment as well as some temporary increase in turbidity. These impacts are not expected to adversely affect the aesthetic resources over the long term and once construction ends, conditions will return to pre-project levels.

(e) Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. No such designated sites are located within the project area. However, the Key Biscayne National Park is located south of the proposed borrow areas and the Key Biscayne Artificial

Reef Special Management Zone is located immediately east. It is not expected that construction activities will affect any resources in these areas.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. There will be no cumulative impacts that result in a major impairment of water quality of the existing aquatic ecosystem as a result of the placement of fill at the project site.

h. Determination of Secondary Effects on the Aquatic Ecosystem. There will be no secondary impacts on the aquatic ecosystem as a result of the dredging.

III. Findings of Compliance or Non-compliance with the

Restrictions on Discharge.

a. No significant adaptations of the guidelines were made relative to this evaluation.

b. No practicable alternative exists which meets the study objectives that does not involve discharge of fill into waters of the United States. Further, no less environmentally damaging practical alternatives to the proposed actions (use of the proposed borrow site) exist. The use of upland and or other sand sources would cause the cost of hauling and/or bulk purchase price to be significantly higher than the use of the proposed borrow site. In addition, the impacts of using other sources on cultural resources, protected species, and other environmental factors would likely be equal to or greater than the impacts of the proposed action. The no action alternative would allow the present condition of the shoreline to continue and would not provide the benefits needed for storm damage protection.

c. After consideration of disposal site dilution and dispersion, the discharge of fill materials will not cause or contribute to, violations of any applicable State water quality standards for Class III waters. The discharge operation will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

d. The dredging of and disposal of dredged materials for beach construction will not jeopardize the continued existence of any species listed as threatened or endangered or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973, as amended. Standard conditions for monitoring and relocating turtle nests would be employed. The requirements in the Regional Biological Opinion dated September 25, 1997 from the National Marine Fisheries Service for use of a hopper dredge would be followed.

e. The dredging and placement of fill material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic species and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values will not occur.

f. Appropriate steps have been taken to minimize the adverse environmental impact of the proposed action. The proposed borrow area has low silt content, therefore, turbidity due to silt will be low when dredging and discharging. Turbidity will be monitored so that if levels exceed State water quality standards of 29 NTU's above background, the contractor will be required to cease work until conditions return to normal. In the vicinity of reef and other hard grounds, measures would be taken to minimize sediment deposition on sensitive reef organisms.

g. On the basis of the guidelines, the proposed dredging and disposal sites are specified as complying with the requirements of these guidelines.

APPENDIX B - COASTAL ZONE MANAGEMENT CONSISTENCY

FLORIDA COASTAL ZONE MANAGEMENT PROGRAM

FEDERAL CONSISTENCY EVALUATION PROCEDURES

PROPOSED MODIFICATIONS AT SUNNY ISLES

DADE COUNTY BEACH EROSION CONTROL

AND HURRICANE PROTECTION PROJECT

DADE COUNTY, FLORIDA

1. Chapter 161, Beach and Shore Preservation. The intent of the coastal construction permit program established by this chapter is to regulate construction projects located seaward of the line of mean high water and which might have an effect on natural shoreline processes.

Response: The proposed plans and information will be submitted to the state in compliance with this chapter.

2. Chapters 186 and 187, State and Regional Planning. These chapters establish the State Comprehensive Plan, which sets goals that articulate a strategic vision of the State's future. It's purpose is to define in a broad sense, goals, and policies that provide decision-makers directions for the future and provide long-range guidance for an orderly social, economic and physical growth.

Response: The proposed project has been coordinated with various Federal, State and local agencies during the planning process. The project meets the primary goal of the State Comprehensive Plan through preservation and protection of the shorefront development and infrastructure.

3. Chapter 252, Disaster Preparation, Response and Mitigation. This chapter creates a state emergency management agency, with the authority to provide for the common defense; to protect the public peace, health and safety; and to preserve the lives and property of the people of Florida.

Response: The proposed project involves placing beach compatible material onto an eroding beach and constructing a breakwater to stabilize the beach as a protective means for residents, development and infrastructure located along the Atlantic shoreline within the community of Sunny Isles in Dade County. Therefore, this project would be consistent with the efforts of Division of Emergency Management.

4. Chapter 253, State Lands. This chapter governs the management of submerged state lands and resources within state lands. This includes archeological and historical resources; water resources; fish and wildlife resources; beaches and dunes; submerged grass beds and other benthic communities; swamps, marshes and other wetlands; mineral resources; unique natural features; submerged lands; spoil islands; and artificial reefs.

Response: The proposed beach nourishment would create increased recreational beach and potential sea turtle nesting habitat. No seagrass beds are located within the area proposed to receive fill. Buffer zones will be used to protect hardbottom communities near the borrow area. Buffer zones will also be used to protect potentially significant magnetic anomalies identified in the vicinity of the borrow areas. The proposed project would comply with the intent of this chapter.

5. Chapters 253, 259, 260, and 375, Land Acquisition. This chapter authorizes the state to acquire land to protect environmentally sensitive areas.

Response: Since the affected property already is in public ownership, this chapter does not apply.

6. Chapter 258, State Parks and Aquatic Preserves. This chapter authorizes the state to manage state parks and preserves. Consistency with this statute would include consideration of projects that would directly or indirectly adversely impact park property, natural resources, park programs, management or operations.

Response: The proposed project area does not contain any state parks or aquatic preserves. The Key Biscayne National Park is located south of the proposed borrow areas and the Key Biscayne Artificial Reef Special Management Zone is located immediately east. It is not expected that construction activities

will affect any resources in these areas. The project is consistent with this chapter.

7. Chapter 267, Historic Preservation. This chapter establishes the procedures for implementing the Florida Historic Resources Act responsibilities.

Response: This project has been coordinated with the State Historic Preservation Officer (SHPO). Historic Property investigations were conducted in the project area. An archival and literature search, in addition to a magnetometer survey of the proposed borrow area were conducted. A buffer zone will be established to protect a potentially significant anomaly identified in the vicinity of the borrow area. No known historic properties are located on the segment of beach to be renourished. The SHPO concurred with the Corps determination that the proposed project will not adversely affect any significant cultural or historic resources. The project will be consistent with the goals of this chapter.

8. Chapter 288, Economic Development and Tourism. This chapter directs the state to provide guidance and promotion of beneficial development through encouraging economic diversification and promoting tourism.

Response: The proposed beach nourishment, transition fill, and breakwater would protect the beach at Sunny Isles. The larger beach, as a result of this project, will attract tourists by providing additional space for recreation and more protection to recreational facilities along the beach. This would be compatible with tourism for this area and therefore, is consistent with the goals of this chapter.

9. Chapters 334 and 339, Public Transportation. This chapter authorizes the planning and development of a safe balanced and efficient transportation system.

Response: No public transportation systems would be impacted by this project.

10. Chapter 370, Saltwater Living Resources. This chapter directs the state to preserve, manage and protect the marine, crustacean, shell and anadromous fishery resources in state waters; to protect and enhance the marine and estuarine environment; to regulate fishermen and vessels of the state engaged in the taking of such resources within or without state waters; to issue licenses for the taking and processing products of fisheries; to secure and maintain statistical records of the catch of each such species; and, to conduct scientific, economic, and other studies and research.

Response: The proposed beach fill, transition fill, and breakwater construction may cause a temporary short-term impact to infaunal invertebrates from increased turbidity and/or direct burial of these organisms. However, these organisms are highly adapted to the periodic burial by sand in the intertidal zone. These organisms are highly fecund and are expected to return to pre-construction levels within 6 months to one year after construction. No adverse impacts to marine fishery resources are expected. It is not expected that sea turtles would be significantly impacted by this project. Based on the overall impacts of the project, the project is consistent with the goals of this chapter.

11. Chapter 372, Living Land and Freshwater Resources. This chapter establishes the Game and Freshwater Fish Commission and directs it to manage freshwater aquatic life and wild animal life and their habitat to perpetuate a diversity of species with densities and distributions, which provide sustained ecological, recreational, scientific, educational, aesthetic, and economic benefits.

Response: The project will have no effect on freshwater aquatic life or wild animal life.

12. Chapter 373, Water Resources. This chapter provides the authority to regulate the withdrawal, diversion, storage, and consumption of water.

Response: This project does not involve water resources as described by this chapter.

13. Chapter 376, Pollutant Spill Prevention and Control. This chapter regulates the transfer, storage, and transportation of pollutants and the cleanup of pollutant discharges.

Response: The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous

wastes in the work area and will require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. A spill prevention plan will be required.

14. Chapter 377, Oil and Gas Exploration and Production. This chapter authorizes the regulation of all phases of exploration, drilling, and production of oil, gas, and other petroleum products.

Response: This project does not involve the exploration, drilling or production of gas, oil or petroleum product and therefore, this chapter does not apply.

15. Chapter 380, Environmental Land and Water Management. This chapter establishes criteria and procedures to assure that local land development decisions consider the regional impact nature of proposed large-scale development.

Response: The proposed renourishment project will not have any regional impact on resources in the area. Therefore, the project is consistent with the goals of this chapter.

16. Chapter 388, Arthropod Control. This chapter provides for a comprehensive approach for abatement or suppression of mosquitoes and other pest arthropods within the state.

Response: The project will not further the propagation of mosquitoes or other pest arthropods.

17. Chapter 403, Environmental Control. This chapter authorizes the regulation of pollution of the air and waters of the state by the Florida Department of Environmental Regulation (now a part of the Florida Department of Environmental Protection).

Response: A Draft Environmental Impact Statement addressing project impacts has been prepared and was coordinated with the appropriate resource agencies including the Florida Department of Environmental Protection. Environmental protection measures will be implemented to ensure that no lasting adverse effects on water quality, air quality, or other environmental resources will occur. Water Quality Certification will be sought from the State prior to construction. The project complies with the intent of this chapter.

18. Chapter 582, Soil and Water Conservation. This chapter establishes policy for the conservation of the state soil and water through the Department of Agriculture. Land use policies will be evaluated in terms of their tendency to cause or contribute to soil erosion or to conserve, develop, and utilize soil and water resources both onsite or in adjoining properties affected by the project. Particular attention will be given to projects on or near agricultural lands.

Response: The proposed project is not located near or on agricultural lands; therefore, this chapter doe s not apply.

APPENDIX C - PERTINENT CORRESPONDENCE

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